



April 26, 2017

Ms. Tonya Howell  
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11201 Renner Blvd  
Lenexa, Kansas 66219

Subject: **Focused Feasibility Study (Revision 02)**  
**Des Moines TCE NPL Site, Operable Unit 02/04, Building Demolition**  
**Des Moines, Iowa**  
**U.S. EPA Region 7 START 4, Contract No. EP-S7-13-06, Task Order No. 0144**  
**Task Monitor: Tonya Howell**

Dear Ms. Howell:

Tetra Tech, Inc. is submitting the attached Focused Feasibility Study (Revision 02) report regarding the Des Moines TCE NPL site, Operable Unit 02/04, Building Demolition, in Des Moines, Iowa. The report has been updated based on comments received March 23, 2017. If you have any questions or comments, please contact me at (816) 412-1767.

Sincerely,

A handwritten signature in cursive script that reads 'Mike Williams'.

Mike Williams, CPG  
START Project Manager

A handwritten signature in cursive script that reads 'Ted Faile'.

Ted Faile, PG, CHMM  
START Program Manager

Enclosures

cc: Debra Dorsey, START Project Officer (cover letter only)

**DES MOINES TCE NPL SITE  
OPERABLE UNIT 02/04  
BUILDING DEMOLITION  
DES MOINES, IOWA  
FOCUSED FEASIBILITY STUDY**

**Superfund Technical Assessment and Response Team (START) 4**

**Contract No. EP-S7-13-06, Task Order 0144**

Prepared For:

U.S. Environmental Protection Agency  
Region 7  
11201 Renner Blvd.  
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April 26, 2017

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## ACRONYMS

ACM	Asbestos-containing material
AOC	Area of contamination
ARAR	Applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	<i>Code of Federal Regulations</i>
COC	Chemical of concern
DCE	Dichloroethene
Dico	Dico, Inc.
EPA	U.S. Environmental Protection Agency
FS	Feasibility study
HDPE	High-density polyethylene
HHRA	Human health risk assessment
IAC	<i>Iowa Administrative Code</i>
IC	Institutional control
KDHE	Kansas Department of Health and Environment
LDR	Land disposal restriction
mil	0.001 inch
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NESHAPS	National Emission Standards for Hazardous Air Pollutants
O&M	Operations and maintenance
OMB	Office of Management and Budget
OU	Operable unit
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethene
ppm	Parts per million
RAO	Remedial Action Objective
RACER	Remedial Action Cost Engineering and Requirements
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SPA	South Pond Area
START	Superfund Technical Assistance and Response Team
TBC	To be considered
TBD	To be determined
TCE	Trichloroethene
Tetra Tech	Tetra Tech, Inc.
TSCA	Toxic Substances Control Act
US	United States
U.S.C.	<i>United States Code</i>

## 1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) directed the Tetra Tech Inc. (Tetra Tech) Superfund Technical Assessment and Response Team (START) to prepare a Focused Feasibility Study (FS) report regarding the Des Moines Trichloroethene (TCE) Site (site) in Des Moines, Iowa (Figure 1). An FS is a mechanism for developing, screening, and evaluating alternatives for remedial actions to address risk identified during previous site investigations. The purpose of this Focused FS is to support an update of the 1996 FS prepared by Black and Veatch (Black and Veatch Special Projects Corp. [Black and Veatch] 1996). This Focused FS addresses Operable Unit (OU) 02/04 related to demolition of buildings. An FS addressing the “South Pond Area” (SPA) will be submitted under separate cover.

The site is in south-central Des Moines on the east side of the Raccoon River (Figure 1). The site is a 43-acre property formerly operated by Dico, Inc. (Dico). It is southwest of the intersection of W. Martin Luther King Jr. Parkway and SW 16<sup>th</sup> Street in Des Moines, Polk County, Iowa. The site is within Section 8, Township 78 North, Range 42 West. The site, as outlined in the 1996 Record of Decision (ROD), includes Buildings 1, 2, and 3; and slab foundations remaining for the Maintenance Building and Buildings 4 and 5. For the purposes of this Focused FS, the Office Building and Production Building are also included as part of the site. A surface water feature at the south end of the site is referred to as the SPA. The SPA was identified in the 1996 FS as part of OU4, called the South Pond/Drainage Area Source Control OU. OU4 was delineated to address pesticide contamination in soils and buildings in the southeast portion of the site.

For approximately 40 years, historical operations at the site have included a variety of industrial uses and operations—steel wheel manufacturing, chemical and herbicide distribution, and pesticide formulation processes. Releases during Dico’s operations at the site included the following: TCE, 1,2-dichloroethene (DCE), and vinyl chloride in groundwater; residual pesticides and metals in shallow soils; and pesticides within buildings and soils on the southern end of the property, and within drainage areas. See the 1996 FS for more information (Black and Veatch 1996). The site is divided into four OUs:

- OU1 – groundwater TCE plume
- OU2 – originated as source soils associated with TCE groundwater contamination, but later focused on residual pesticides and metals in shallow soils and polychlorinated biphenyls (PCB) in buildings

- OU3 – source area of tetrachloroethene (PCE) groundwater contamination north of the site
- OU4 – pesticides in soil and buildings on the southern end of the site (including the SPA), and in drainage areas of the site.

The 1986 ROD addressed OU1 (EPA 1986), the 1992 ROD addressed OU3 (EPA 1992), and the 1996 ROD addressed OU2 and OU4 (EPA 1996). The 1996 ROD for OU4 selected Building Alternative 2 – Limited Action and Soil Alternative 2 – Limited Action. Under these remedies, contamination within and underneath the buildings would remain in place and exposure to the contamination would be controlled through land use controls (both engineered controls and institutional controls). In the mid-1990s, several cleanup actions occurred to address contamination at the site in surface soils and buildings. Furthermore, a group of potentially responsible parties excavated contaminated soils from a drainage ditch adjacent to the site and the SPA (EPA 2012).

The 5-year review completed in April 2013 deferred the protectiveness determinations for OU4 and recommended sampling the SPA to assess ecological risks (EPA 2013). The 2013 5-year review also identified risk to trespassers in the buildings at OU4, due to broken windows and unsecured entrances in the buildings where the encapsulation over the contaminated areas has failed, and recommended monitoring to determine the extent of exposure to trespassers. Sampling and an ecological risk assessment for the SPA was completed in October 2015, and indicated an unacceptable risk to ecological receptors due to pesticide and PCB contamination (EPA 2015). An addendum to the 5-year review was then completed in 2016 (EPA 2016). This addendum indicated that trespassers from the indigent community were removed from the buildings at OU4 and security measures were put in place to prevent additional trespassing. The addendum recommended continued efforts to verify that the buildings containing contamination be made inaccessible to trespassers and updating the human health risk assessment (HHRA) to assess potential human health risk. This addendum indicated that the remedy at OU4 is protective regarding contamination in the buildings, but is not protective in the SPA due to the conclusion of the 2015 ecological risk assessment. A HHRA addendum was then completed in January 2017 as recommended by the 2016 5-year review, and took into account new potential land uses at the OU and new data that had been acquired at the OU (Tetra Tech 2017a). The HHRA addendum showed unacceptable risk to human receptors at the SPA. However, the addendum did not evaluate risk based on contamination in building materials. Manufacturing operations at the site have ceased, and the only activities on site relate to operation and maintenance of the pump and treat remediation system associated with OU1. The site is fenced, and the property owner provides site security.

Land use in the surrounding area is changing, and much of this area has been rezoned since the remedy was selected for OU4 in the 1996 ROD. The City of Des Moines is planning a major redevelopment project in the River Point West area east of the Dico property. The site was previously zoned for industrial use. However, on June 13, 2005, most of the Dico property was rezoned to the Central Business Mixed Use District C-3 B designation. This allows for a variety of uses including residential, recreational, office, commercial, and retail.

Due to the changing land use, this Focused FS report evaluates alternatives for addressing human health risk associated with buildings and slabs that remain on site in a way that is compatible with changing land use. This Focused FS report addresses the buildings and slabs that remain on site and does not include an evaluation of alternatives to address contaminated soil or groundwater beneath the buildings and slabs. The remedy selected for the contaminated soil beneath the buildings and slabs in the 1996 ROD remains in place and has been determined to be protective of human health and the environment (EPA 2013). Figure 2 is a site layout map.

This Focused FS report was prepared in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and EPA's Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (EPA 1988). The NCP defines appropriate remediation as a cost-effective remedial alternative that effectively mitigates and minimizes threats to and provides adequate protection of human health, welfare, and the environment. Remedial alternatives evaluated in this Focused FS report vary in cost and in level of protection they afford to human health.

## **2.0 REMEDIAL ACTION OBJECTIVES AND PRELIMINARY REMEDIATION GOALS**

Several pesticides were detected in samples of building materials and concrete, and in wipe samples. Pesticides detected in the slab foundations of the Maintenance Building and Building 4 contained Resource Conservation and Recovery Act (RCRA) listed wastes as a result of spills of listed waste when Aldrin (Hazardous Waste Code P004) stored in the Maintenance Building was transferred to Building 4 and sprayed onto fertilizer. A 2,000-gallon vessel stored in the Maintenance Building was used to heat Aldrin during formulation operations (Eckenfelder Inc. 1992).

It is unclear if contamination within the remaining buildings and slab foundations on site derived from poor waste management or releases of product that is not RCRA listed waste. Therefore, the source is unknown and is not considered a RCRA listed waste. Pesticides detected in these other buildings and slab foundations may contain RCRA characteristic waste and therefore would be characterized prior to disposal. Remedial action objectives (RAO) were developed to address the demolition and disposal of building materials only and do not address soil in this Focused FS.

The general RAO specified in the 1996 ROD is as follows:

“Maintain the Buildings, asphalt cap, and SPA so that exposure pathways continue to be controlled or minimized. This will minimize risk for both the current and anticipated future industrial use of the site, and will protect human health and the environment.”

The specific RAO, listed in the 1996 ROD, related to the nature and extent of contamination in buildings at the site is as follows:

“To maintain control of potential exposure pathways related to contaminated materials in Buildings 1 through 5 and the Maintenance Building, and to protect human health and the environment during continued and future industrial uses.”

No new RAOs were developed in this Focused FS because the RAOs identified in the 1996 ROD for the building materials remain protective of human health and the environment. Additional alternatives to address the building materials, which will meet these RAOs, are evaluated in this Focused FS because the remedy selected in the 1996 ROD is no longer protective of human health and the environment (EPA 2013, EPA 2016). Also, the land use has changed from industrial to Central Business Mixed Use District C-3 B designation, as noted in Section 1.0. Leaving the contaminated buildings in place is not compatible with this new land use designation.



### **3.0 EXTENT OF CONTAMINATION**

In July 2016, Tetra Tech conducted an environmental characterization of buildings, foundations, soil below buildings, and the SPA. The South Pond characterization is included under separate cover in the South Pond FS (Tetra Tech 2017b). The building investigation included collection of the following samples for analyses for COCs:

- ☐ Wipe samples from building surfaces
- ☐ Building material samples
- ☐ Concrete core samples from building foundations and slabs.

Results of the site characterization indicated presence of pesticides, PCBs, and dioxins in several building materials across the site. Pesticides and PCB sample locations are shown on Figures 3 through 5; analytical summary tables of pesticides and PCBs (Tables 1 through 3 attached) correspond to each figure.

#### 4.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section (§) 121(d)(1), at 42 U.S.C. § 9621(d) requires that remedial actions attain (or the decision document justify waiver of) environmental regulations, standards, or criteria promulgated under federal or more stringent state laws determined to be applicable or relevant and appropriate requirements (ARAR).

The NCP at 40 *Code of Federal Regulations* (CFR) § 300.5 defines applicable requirements as “those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance found at a CERCLA site...” The NCP at 40 CFR § 300.5 defines relevant and appropriate requirements as “those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not ‘applicable’ to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations *sufficiently similar to those encountered at the CERCLA site and that their use is well suited to the particular site...*” (emphasis added).

Compliance with ARARs requires compliance only with the substantive requirements specified within the statute or regulation, and does not require compliance with procedural requirements, such as permitting when response actions are conducted entirely on site. CERCLA § 121(e)(1) states that “No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely onsite, where such remedial action is selected and carried out in compliance with this section.” For any portion of a removal or remedial action conducted off site, such as off-site disposal in a permitted landfill, compliance with applicable requirements and with both substantive and procedural components is required.

Potential federal and state ARARs are identified in this FS. Potential federal ARARs were identified based on a review of site-specific characteristics and remedial actions under evaluation, and federal environmental statutes and regulations. Potential state ARARs were identified based on a review of site-specific characteristics and remedial actions under evaluation, and state-delegated environmental programs and other state environmental statutes and regulations. For a state requirement, including an applicable state requirement, to be identified as a potential state ARAR, the state requirement must be more stringent than the corresponding federal ARAR. EPA will select the final ARARs (no longer potential) in the ROD.

ARARs are generally divided into three categories: chemical-, location-, and action-specific requirements. Chemical-specific ARARs are generally health- or risk-based numerical values or methodologies applied to site-specific conditions that result in establishment of cleanup levels. These values establish acceptable amounts or concentrations of chemicals that may be found in, or discharged to, the ambient environment. Chemicals found in the on-site buildings and building materials include pesticides, PCBs, and dioxins. No statutory or regulatory standards for pesticides or dioxins in building debris have been established that specify potential cleanup levels. PCBs found in the building material are in bulk product waste and are not considered PCB remediation waste because at the time of designation for disposal, the PCB-contaminated building material is still attached to the building and the building demolition will be completed in the remedial action (EPA 2012). The regulations specified in 40 CFR § 761.61—including the PCB self-implementing cleanup option in 40 CFR § 761.61(a)(4)(i), which specifies numerical standards that may be used as cleanup standards at CERCLA sites—were not identified as potential ARARs because no PCB remediation waste is present in the buildings. As a result, no potential chemical-specific ARARs were identified. Location-specific ARARs are restrictions or requirements placed on protected locations, including historic places, wetlands, and sensitive ecosystems or habitats. The site is not within a 100-year floodplain due to presence of a levee. The site is within a 500-year floodplain, so potential location-specific ARARs were identified for protection of permanent and temporary facilities constructed at the site. No other protected or regulated resources are present at the building site, so no other potential location-specific ARARs were identified. Potential federal location-specific ARARs are identified in Table 1. No potential state location-specific ARARs were identified for protection of the floodplain. Potential Action-specific ARARs are requirements triggered by a remedial action on site. Action-specific ARARs generally do not determine the remedial alternative; rather, they determine how an alternative must be implemented. No potential action-specific ARARs were identified for or are necessary for the No Action alternative. Potential federal action-specific ARARs are listed in Table 2. Potential state action-specific ARARs are listed in Table 3. Table 4 summarizes feasibility options.

TABLE 1

**POTENTIAL FEDERAL LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

Action	Summary of the Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
<b>FLOODPLAIN</b>					
Construction of temporary staging pile and construction of permanent covers over contaminated building material, soil, and fill	Federal agencies must evaluate potential effects of action they may take in a floodplain and avoid adverse effects to the extent possible. Federal agencies must implement acceptable flood proofing and other flood protection measures for new facilities constructed in a floodplain.	Construction of a structure or facility in a floodplain	Executive Order 11988	Not an ARAR Identified as TBC criteria	Executive Orders are not legally enforceable, and therefore are not identified as potential ARARs. As a result, this Executive Order was evaluated as TBC.  The building site is within the 500-year floodplain of the Raccoon River. As a result, this Executive Order is identified as TBC for construction of temporary staging piles to hold and sort building debris prior to being shipped off site for disposal and for the permanent cover over contaminated building debris, soil, and fill. These facilities are necessary for implementation of the remedial action and will be designed to prevent washout from a 500 year flood.
Construction of temporary staging pile and construction of permanent cover over contaminated building material, soil, and fill	Modified Executive Order 11988 to establish the Federal Flood Risk Management Standard to improve resilience to flood risks. Redefined "floodplain" to use a higher vertical flood elevation and corresponding horizontal floodplain.	Construction of a structure or facility in a floodplain	Executive Order 13690	Not an ARAR Identified as TBC criteria	Executive Orders are not legally enforceable, and there are not identified as potential ARARs. As a result, this Executive Order was evaluated as TBC criteria.  This Executive Order redefined the term floodplain to include the area subject to flooding by the 0.2 percent annual chance of flood (the 500 year floodplain). The building site is within the 500 year floodplain.  The other requirements of Executive Order 11988, identify and evaluate practicable alternatives to locating in a floodplain, identify impacts of the proposed action in the floodplain, and minimize, restore, and preserve the floodplain, remain in effect.
<b>Resource Conservation and Recovery Act</b>					
Construction of temporary staging pile and construction of permanent covers over contaminated building material, soil, and fill	A hazardous waste facility within a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout by a 100-year flood, unless the owner or operator can demonstrate procedures in effect that will safely remove the waste, before flood waters can reach the facility.	Construction of new RCRA hazardous waste facility within a 100-year floodplain	40 CFR § 264.18(b)	Relevant and appropriate	The site is within the 500-year floodplain, so these requirements are identified as relevant and appropriate ARARs for construction of temporary staging piles and the permanent cover over contaminated soil and fill.

Notes:

TBC      To be considered criteria

TABLE 2

**POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

Component of the Remedial Action Alternative	Summary of the Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
<b>ALTERNATIVES</b>					
<b>Building Demolition with Off-Site Disposal (Alternative 2)</b>					
<b>Resource Conservation and Recovery Act</b>					
Generate waste	A solid waste exhibits the characteristic of toxicity if, by use of the toxicity characteristic leaching procedure, the extract from a representative sample of the waste contains any contaminant listed in Table 1, and concentration equals or exceeds the benchmark value for that contaminant listed in Table 1.	Waste	40 CFR § 261.24	Applicable	This regulation is potentially applicable to off-site disposal of building debris that would be waste, and any other waste generated during the remedial action. Waste associated with the onsite building foundations of Building 4 and the Maintenance Building is considered RCRA listed waste and would not be subject to this potential ARAR. Demolition waste associated with other buildings is not considered listed waste because it was not contaminated by a spill of listed waste. The demolition waste associated with other buildings would be subject to this potential ARAR and would be characterized to determine if it meets the definition of toxicity characteristic waste.
Generate waste	Discarded commercial chemical products, off-specification species, container residues, and spill residues are considered P-listed hazardous waste and U-listed hazardous waste.	Waste	40 CFR § 261.33	Applicable	This regulation is potentially applicable to off-site disposal of waste. Waste associated with the building foundations of Building 4 and the Maintenance Building is considered P- and U-listed waste.
Generate waste	Person who generates waste shall determine if the waste is a RCRA hazardous waste.	Generator of waste	40 CFR §§ 262.10(a), 262.11	Applicable	These regulations are potentially applicable to off-site disposal of building debris that would be waste, and any other waste generated during the remedial action. Waste would be characterized prior to shipment off site for disposal. Waste associated with the onsite building foundations of Building 4 and the Maintenance Building is considered RCRA listed waste. Waste associated with other buildings is not considered listed waste because it was not contaminated by a spill of listed waste. The demolition waste associated with other buildings would be characterized to determine if it meets the definition of RCRA characteristic waste.

TABLE 2 (Continued)

**POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

Component of the Remedial Action Alternative	Summary of the Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
<b>ALTERNATIVES</b>					
<b>Building Demolition with Off-Site Disposal (Alternative 2)</b>					
Generate waste	Provides requirements for analyzing waste for determining whether waste is hazardous.	Generator of waste	40 CFR § 264.13	Applicable	These regulations are potentially applicable to off-site disposal of building debris that would be waste, and any other waste generated during the remedial action. Waste would be characterized prior to shipment off site for disposal.
Temporarily stage debris for off-site disposal	Allows generators to accumulate solid remediation waste in a staging pile designed and operated pursuant to these requirements without triggering LDRs or minimum technology requirements. In addition, activities intended to prepare the waste for subsequent management or treatment are allowed to occur in staging piles.	RCRA hazardous waste temporarily staged for off-site disposal	40 CFR §264.554	Applicable and Relevant and Appropriate	<p>The building debris would be temporarily staged in order to segregate the various waste streams prior to off-site disposal.</p> <p>Waste associated with the onsite building foundations of the Building 4 and of the Maintenance Building are contaminated as a result of spills of listed waste; thus these foundations contain listed waste and must be managed as listed waste. Debris from the building foundations will be temporarily stored in a staging pile prior to off-site disposal. The staging pile regulations would be applicable to the demolition waste associated with Building 4 and the Maintenance Building foundations.</p> <p>Building debris from other buildings does not contain listed waste, but may contain RCRA characteristic waste. Because characterization of the waste is not fully known, the staging pile regulations would be relevant and appropriate requirements for the demolition waste associated with other buildings.</p>
Close temporary staging pile and construct cover over contaminated soil and fill remaining on site	The owner or operator must close the facility in a manner that minimizes need for further maintenance; and controls, minimizes, or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface water or atmosphere.	RCRA hazardous waste management facility	40 CFR § 264.111	Applicable and Relevant and Appropriate	<p>These requirements are potential ARARs for closing the temporary staging pile.</p> <p>These requirements are also applicable for leaving RCRA listed hazardous waste (soil underneath Building 4 and the Maintenance Building) closed in place and relevant and appropriate for other contamination in the soil closed in place.</p>

TABLE 2 (Continued)

**POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

<b>Component of the Remedial Action Alternative</b>	<b>Summary of the Requirement</b>	<b>Prerequisite</b>	<b>Citation</b>	<b>Preliminary ARAR Determination</b>	<b>Comments</b>
<b>ALTERNATIVES</b>					
<b>Building Demolition with Off-Site Disposal (Alternative 2)</b>					
Construct cover over contaminated soil and fill remaining on site	Post-closure use of the property on or in which hazardous waste remains after partial or final closure must never be allowed to disturb the integrity of the final cover, liner, or any other components of the containment system, or function of the facility's monitoring systems.	RCRA hazardous waste management facility	40 CFR § 264.117(c)	Applicable and Relevant and Appropriate	These requirements are applicable for leaving RCRA listed hazardous waste (soil underneath Building 4 and the Maintenance Building) closed in place and are relevant and appropriate for leaving other contamination in the soil closed in place.
Construct cover over contaminated soil and fill remaining on site	A map must be prepared showing exact location and dimensions of each waste management cell with respect to permanently surveyed benchmarks.	RCRA hazardous waste landfill	40 CFR § 264.309(a)	Applicable and Relevant and Appropriate	These requirements are applicable for leaving RCRA listed hazardous waste (soil underneath Building 4 and the Maintenance Building) closed in place and relevant and appropriate for leaving other contamination in the soil closed in place.
Construct cover over contaminated soil and fill remaining on site	Final cover design and construction requirements.	RCRA hazardous waste landfill	40 CFR §264.310	Applicable and Relevant and Appropriate	These requirements are applicable for leaving RCRA listed hazardous waste (soil underneath Building 4 and the Maintenance Building) closed in place and relevant and appropriate for leaving other contamination in soil closed in place.
Close temporary staging pile and construct cover over contaminated soil and fill remaining on site	At closure, owner shall remove or decontaminate all waste residues, contaminated containment system components, contaminated subsoils, and structures and equipment contaminated with waste and leachate, and manage them as hazardous waste. If waste is left on site, post-closure care shall be performed in accordance with the closure and post-closure care requirements that apply to landfills.	RCRA hazardous waste pile	40 CFR § 264.258(a)	Applicable and Relevant and Appropriate	These requirements are potential ARARs for closing the temporary staging pile.  These requirements are also applicable for leaving RCRA listed hazardous waste (soil underneath Building 4 and the Maintenance Building) closed in place and relevant and appropriate for leaving other contamination in the soil closed in place.

TABLE 2 (Continued)

**POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

Component of the Remedial Action Alternative	Summary of the Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
<b>ALTERNATIVES</b>					
<b>Building Demolition with Off-Site Disposal (Alternative 2)</b>					
Monitor groundwater	Owners and operators of landfills that dispose of hazardous waste must implement a groundwater monitoring program to detect, characterize, and respond to releases to the uppermost aquifer unless the owner or operator is exempt from this requirement, including a finding of no potential for migration of liquid from a regulated unit to the uppermost aquifer during the active life of the regulated unit and the post-closure period.	RCRA hazardous waste landfill	40 CFR §§ 264.90 and 264.91	Applicable	These requirements are applicable to RCRA hazardous waste disposal sites. These regulations require groundwater monitoring unless the owner or operator falls within an exception, including a finding of no potential for migration of liquids into groundwater.
Generate waste	A generator of waste shall determine if the waste has to be treated before it can be land disposed, which may occur concurrently with the hazardous waste determination required in 40 CFR § 262.11.	Waste	40 CFR § 268.7	Applicable	These regulations are potentially applicable to waste, including the building debris, to be sent off site for disposal. The waste would be characterized and a determination regarding required treatment would be made prior to off-site disposal.
Generate waste	The initial generator of a waste shall determine each EPA hazardous waste number (waste code) in order to determine the applicable treatment standards, which may occur concurrently with the hazardous waste determination required in 40 CFR § 262.11.	Waste	40 CFR § 268.9	Applicable	These regulations are potentially applicable to waste, including the building debris, to be sent off site for disposal. The waste would be characterized and a determination would be made regarding required treatment prior to off-site disposal.
Generate waste	EPA may grant variance from an LDR treatment standard.	RCRA hazardous waste subject to LDRs	40 CFR § 268.44	Applicable	These regulations are potentially applicable to waste, including the building debris to be sent off site for disposal that contains the listed waste or meets the definition of RCRA characteristic waste. If necessary and appropriate, a determination may be made that a treatment variance is appropriate.



TABLE 2 (Continued)

**POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

Component of the Remedial Action Alternative	Summary of the Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
<b>ALTERNATIVES</b>					
<b>Building Demolition with Off-Site Disposal (Alternative 2)</b>					
Generate waste	Treatment standards for hazardous debris.	RCRA hazardous waste subject to LDRs	40 CFR § 268.45	Applicable	Hazardous debris must be treated prior to land disposal unless, pursuant to 40 CFR § 261.3(f)(2), the debris no longer contains hazardous waste or the debris is treated to the waste-specific treatment standards specified in 40 CFR § 268.45.
<b>Clean Air Act</b>					
Building demolition	Owner or operator of a demolition or renovation activity must thoroughly inspect the affected facility where the demolition will occur for presence of asbestos. If asbestos is found, the owner or operator must comply with the notification requirements of 40 CFR § 61.145(b) and the procedures for asbestos emission control specified in 40 CFR § 61.145(c).	Demolition of any institutional, commercial, public, industrial, or residential structure with less than four units	40 CFR § 61.145	Applicable	The substantive provisions of the NESHAPS for asbestos are applicable to demolition of the building. An asbestos survey will be completed prior to demolition of the building. If asbestos-containing materials are found, the demolition must comply with the substantive procedures in 40 CFR § 61.145(c).
Building demolition	Each owner or operator of a source covered under §§ 61.144, 61.145, 61.146, and 61.147 must (1) discharge no visible emissions to the outside air during collection, processing, packaging, and transporting; (2) deposit the asbestos-containing waste at the waste disposal site as soon as is practical; (3) mark vehicles used to transport asbestos-containing waste; (4) maintain transportation records; and (5) make records available for inspection.	Owner or operator of a source of asbestos emissions (including a source regulated under 40 CFR § 61.145)	40 CFR § 61.150	Applicable	The substantive provisions of the NESHAPs for asbestos disposal are applicable to asbestos-containing waste identified in the building demolition.

TABLE 2 (Continued)

**POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

Component of the Remedial Action Alternative	Summary of the Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
<b>ALTERNATIVES</b>					
<b>Building Demolition with Off-Site Disposal (Alternative 2)</b>					
<b>Toxic Substances Control Act</b>					
Building demolition	PCB bulk product waste must be disposed of in accordance with (1) performance-based disposal, (2) disposal in solid waste landfills, or (3) risk-based disposal approval.	PCB bulk product waste means waste derived from manufactured products containing PCBs in a non-liquid state, at any concentration at time of designation for disposal $\geq 50$ ppm PCBs	40 CFR § 761.62(b)	Relevant and appropriate	In the promulgation of the TSCA rule at 40 CFR § 761.61, EPA stated that Part 761 does not bind other cleanup programs such as CERCLA or RCRA; however, EPA expects that CERCLA cleanups would typically comply with one of the three cleanup options provided in § 761.61. Therefore, this regulation, which is within Part 761, is not identified as applicable, but is identified as relevant and appropriate to PCBs present in building materials from manufactured products (not as a result of a spill). EPA has determined that the PCB-contaminated building material is PCB bulk product waste because at the time of designation for disposal, the PCB material is still attached to the building.
Building demolition	Requirements for sampling non-liquid, non-metal PCB bulk product waste for purposes of characterization for PCB disposal in accordance with 40 CFR § 761.62.	PCB bulk product waste means waste derived from manufactured products containing PCBs in a non-liquid state, at any concentration at time of designation for disposal $\geq 50$ ppm PCBs	40 CFR §§ 761.340 through 761.359 (Subpart R)	Relevant and appropriate	PCB bulk product waste is present in the building materials. Sampling the building materials for PCB bulk product waste would be completed according to these requirements.

TABLE 2 (Continued)

**POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

Component of the Remedial Action Alternative	Summary of the Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
<b>ALTERNATIVES</b>					
<b>Building Demolition with Off-Site Disposal (Alternative 2)</b>					
Building demolition	Procedure for double wash/rinse method for decontaminating non-porous surfaces.	PCB bulk product waste means waste derived from manufactured products containing PCBs in a non-liquid state, at any concentration at time of designation for disposal ≥ 50 ppm PCBs	40 CFR §§ 761.360 through 761.378	Relevant and appropriate	PCB bulk product waste is present in the building materials. Non-porous surfaces of PCB bulk product waste may be decontaminated using this method prior to disposal.
<b>Clean Water Act</b>					
Building demolition and construction of the cap	Construction activities that disturb 1 acre or more must use best management practices to control storm water discharges.	Construction activities affecting at least 1 acre.\	Clean Water Act § 402 40 CFR §122.44(k)(2) and (4)	Applicable	Building demolition and construction of the cap will affect at least 1 acre, so the storm water discharge requirements are applicable. Best management practices will be used to control storm water discharge to nearby surface water bodies. See Table 3, Potential State ARARs, for a discussion of compliance with these Clean Water Act ARARs.

TABLE 2 (Continued)

**POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

Action	Summary of the Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
<b>ALTERNATIVES</b>					
<b>Building Demolition with On-site Containment (Alternative 3)</b>					
<b>Resource Conservation and Recovery Act</b>					
Generate waste	A solid waste exhibits the characteristic of toxicity if, by application of the toxicity characteristic leaching procedure, the extract from a representative sample of the waste contains contaminant listed in Table 1 at concentration equaling or exceeding the benchmark value for that contaminant listed in Table 1.	Waste	40 CFR § 261.24	Applicable	This regulation is potentially applicable to off-site disposal of waste generated during the remedial action. Waste associated with the foundations of Building 4 and the Maintenance Building is considered RCRA listed waste and would not be subject to this potential ARAR. Waste associated with other buildings is not considered listed waste because it was not contaminated by a spill of listed waste. The demolition waste associated with other buildings would be subject to this potential ARAR and would be characterized to determine if it meets the definition of toxicity characteristic waste.
Generate waste	Discarded commercial chemical products, off-specification species, container residues, and spill residues are considered P-listed hazardous waste and U-listed hazardous waste.	Waste	40 CFR § 261.33	Applicable	This regulation is potentially applicable to off-site disposal of waste generated during the remedial action. Waste associated with the foundations of Building 4 and the Maintenance Building is considered P- and U-listed waste.
Construct covers over crushed building debris left on site	The owner or operator must close the facility in a manner that minimizes need for further maintenance; and controls, minimizes, or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface water or atmosphere.	RCRA hazardous waste management facility	40 CFR § 264.111	Applicable and relevant and appropriate	These requirements are applicable for leaving RCRA listed hazardous waste (foundations of Building 4 and of the Maintenance Building) closed in place over the southern portion of the site and are relevant and appropriate for leaving other waste and contamination closed in place over the northern portion of the site.

TABLE 2 (Continued)

**POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

Action	Summary of the Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
<b>ALTERNATIVES</b>					
<b>Building Demolition with On-site Containment (Alternative 3)</b>					
Construct covers over crushed building debris left on site	Post-closure use of the property on or in which hazardous waste remains after partial or final closure must never be allowed to disturb the integrity of the final cover, liner, or any other components of the containment system, or function of the facility's monitoring systems.	RCRA hazardous waste management facility	40 CFR § 264.117(c)	Applicable and relevant and appropriate	These requirements are applicable for leaving RCRA listed hazardous waste (foundations of Building 4 and of the Maintenance Building) closed in place over the southern portion of the site and are relevant and appropriate for leaving other waste and contamination closed in place over the northern portion of the site.
Construct covers over crushed building debris left on site	A map must be prepared showing the exact location and dimensions of each waste management cell with respect to permanently surveyed benchmarks.	RCRA hazardous waste landfill	40 CFR § 264.309(a)	Applicable and relevant and appropriate	These requirements are applicable for leaving RCRA listed hazardous waste (foundations of Building 4 and of the Maintenance Building) closed in place over the southern portion of the site and are relevant and appropriate for leaving other waste and contamination closed in place over the northern portion of the site.
Construct cover over crushed building debris left on site	Final cover design and construction requirements.	RCRA hazardous waste landfill	40 CFR §264.310	Applicable	These requirements are applicable for leaving RCRA listed hazardous waste (foundations of Building 4 and of the Maintenance Building) closed in place over the southern portion of the site.
Monitor groundwater	Owners and operators of landfills that dispose of hazardous waste must implement a groundwater monitoring program to detect, characterize, and respond to releases to the uppermost aquifer unless the owner or operator is exempt from this requirement, including a finding of no potential for migration of liquid from a regulated unit to the uppermost aquifer during the active life of the regulated unit and the post-closure period.	RCRA hazardous waste landfill	40 CFR §§ 264.90 and 264.91	Applicable	These requirements are applicable to RCRA hazardous waste disposal sites, which would include the southern portion of the site. These regulations require groundwater monitoring unless the owner or operator falls within an exception, including a finding of no potential for migration of liquids into groundwater.

TABLE 2 (Continued)

**POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

Action	Summary of the Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
<b>ALTERNATIVES</b>					
<b>Building Demolition with On-site Containment (Alternative 3)</b>					
Generate waste	Treatment standards for hazardous debris.	RCRA hazardous waste subject to LDRs	40 CFR § 268.45	Applicable	Some hazardous debris would be sent off-site for disposal. Hazardous debris must be treated prior to off-site land disposal unless, pursuant to 40 CFR § 261.3(f)(2), the debris no longer contains hazardous waste or the debris is treated to the waste-specific treatment standards specified in 40 CFR § 268.45.
<b>Clean Air Act</b>					
Building demolition	Owner or operator of a demolition or renovation activity must thoroughly inspect the affected facility where the demolition will occur for presence of asbestos. If asbestos is found, the owner or operator must comply with the notification requirements of 40 CFR § 61.145(b) and the procedures for asbestos emission control of 40 CFR § 61.145(c).	Demolition of any institutional, commercial, public, industrial, or residential structure with less than four units	40 CFR § 61.145	Applicable	The substantive provisions of the NESHAPS for asbestos are applicable to demolition of the building. An asbestos survey will be completed prior to demolition of the building. If asbestos-containing materials are found, the demolition must comply with the substantive procedures in 40 CFR § 61.145(c).
Building demolition	Each owner or operator of a source covered under §§ 61.144, 61.145, 61.146, and 61.147 must (1) discharge no visible emissions to the outside air during collection, processing, packaging, and transporting; (2) deposit the asbestos-containing waste at the waste disposal site as soon as is practical; (3) mark vehicles used to transport asbestos-containing waste; (4) maintain transportation records; and (5) make records available for inspection.	Owner or operator of a source of asbestos emissions (including a source regulated under 40 CFR § 61.145)	40 CFR § 61.150	Applicable	The substantive provisions of the NESHAPS for asbestos disposal are applicable to asbestos-containing waste identified in the building demolition. An asbestos survey will be completed prior to demolition of the building. If asbestos-containing materials are found, these will be removed and disposed of off site.

TABLE 2 (Continued)

**POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

Action	Summary of the Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
<b>ALTERNATIVES</b>					
<b>Building Demolition with On-site Containment (Alternative 3)</b>					
<b>Toxic Substances Control Act</b>					
PCB waste from building demolition	Any person designing and constructing a cap must do so in accordance with 40 CFR § 264.310(a) and ensure that it complies with the permeability, sieve, liquid limit, and plasticity index parameters in § 761.75(b)(1)(ii) through (b)(1)(v). A cap of compacted soil shall have a minimum thickness of 10 inches; a concrete or asphalt cap shall have a minimum thickness of 6 inches. A cap must be of sufficient strength to maintain its effectiveness and integrity when exposed to the environment.	PCB remediation waste at concentrations $\geq$ 50 ppm PCBs	40 CFR §§ 761.61(a)(7), 761.65(b)(1)(i) through (b)(1)(v)	Relevant and appropriate	In promulgation of the TSCA rule at 40 CFR § 761.61, EPA stated that Part 761 does not bind other cleanup programs such as CERCLA or RCRA; however, EPA expects that CERCLA cleanups would typically comply with one of the three cleanup options provided in § 761.61. Also, the PCBs found at the building demolition site are not from the release of PCBs as PCB remediation waste. Instead, the PCBs found at the building demolition site are PCB bulk product waste. Therefore, these regulations are not identified as applicable, but are identified as relevant and appropriate to PCBs present in a bulk product waste. PCB bulk product waste with concentrations of PCBs exceeding 50 ppm will be disposed of off site. PCB bulk product waste with concentrations at or less than 50 ppm will remain on site, under the RCRA cover. The cover over the PCB bulk product waste and RCRA hazardous waste designed to meet the RCRA requirements, which would also meet these TSCA cover requirements.

TABLE 2 (Continued)

**POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

Action	Summary of the Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
<b>ALTERNATIVES</b>					
<b>Building Demolition with On-site Containment (Alternative 3)</b>					
PCB waste from building demolition	When a cleanup activity under this section includes use of a fence or a cap, the owner of the site must maintain the fence or cap in perpetuity.	PCB remediation waste at concentrations $\geq$ 50 ppm PCBs	40 CFR § 761.61(a)(8)	Relevant and appropriate	In promulgation of the TSCA rule at 40 CFR § 761.61, EPA stated that Part 761 does not bind other cleanup programs such as CERCLA or RCRA; however, EPA expects that CERCLA cleanups would typically comply with one of the three cleanup options provided in § 761.61. Also, the PCBs found at the building demolition site are not from the release of PCBs as PCB remediation waste. Instead, the PCBs found at the building demolition site are PCB bulk product waste. Therefore, these regulations are not identified as applicable, but are identified as relevant and appropriate to PCBs present in bulk product waste. PCB bulk product waste with concentrations of PCBs exceeding 50 ppm will be disposed of off site. PCB bulk product waste with concentrations less than 50 ppm will remain on site, under the RCRA cover. The cover over the PCB bulk product waste and RCRA hazardous waste designed to meet the RCRA requirements, which would also meet these TSCA cover requirements.
PCB waste from building demolition	PCB bulk product waste must be disposed of in accordance with (1) performance-based disposal, (2) disposal in solid waste landfills, or (3) risk-based disposal approval.	PCB bulk product waste means waste derived from manufactured products containing PCBs in a non-liquid state at any concentration at time of designation for disposal $\geq$ 50 ppm PCBs	40 CFR § 761.62(c)	Relevant and appropriate	In promulgation of the TSCA rule at 40 CFR § 761.61, EPA stated that Part 761 does not bind other cleanup programs such as CERCLA or RCRA; however, EPA expects that CERCLA cleanups would typically comply with one of the three cleanup options provided in § 761.61. Therefore, this regulation, which is within Part 761, is not identified as applicable, but is identified as relevant and appropriate to PCBs bulk product waste. PCB bulk product waste with concentrations of PCBs exceeding 50 ppm will be disposed of off site. PCB bulk product waste with concentrations less than 50 ppm will remain on site, under the cover.



TABLE 2 (Continued)

**POTENTIAL FEDERAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

Action	Summary of the Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
<b>ALTERNATIVES</b>					
<b>Building Demolition with On-site Containment (Alternative 3)</b>					
<b>Clean Water Act</b>					
Construct covers over crushed building debris left on site	Construction activity that disturbs 1 acre or more must use best management practices to control stormwater discharges.	Construction activities encompassing at least 1 acre	Clean Water Act § 402 40 CFR §122.44(k)(2) and (4)	Applicable	Demolition and construction of the covers will affect at least 1 acre, so the stormwater discharge requirements are applicable. Best management practices will be used to control stormwater discharge to nearby surface water bodies.  See Table 3, Potential State ARARs, for a discussion of compliance with these Clean Water Act ARARs.

Notes:

IC Institutional controls  
LDR Land disposal restriction  
NESHAPS National Emission Standards for Hazardous Air Pollutants

ppm Parts per million  
TSCA Toxic Substances Control Act

TABLE 3

**POTENTIAL STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
<b>ALTERNATIVES</b>					
<b>Building Demolition with Off-site Disposal (Alternative 2)</b>					
<b>Clean Water Act</b>					
Building demolition and construction of cover	Construction activities that disturb 1 acre or more must use best management practices to control stormwater discharges.	Construction activities that affect 1 acre or more	Clean Water Act § 1342 40 CFR §122.44(k)(2) and (4)	Applicable	<p>Building demolition and construction of the cover over contaminated soil and fill will affect more than 1 acre, so the storm water discharge requirements are applicable. Best management practices will be used to control storm water discharge to nearby surface water bodies.</p> <p>Pursuant to CERCLA § 121(e), permits are not required for the portions of the remedial action that occur entirely on site. The storm water discharge will occur entirely on site; therefore, a permit to discharge the storm water is not required. However, the substantive provisions of Iowa General Permit 2 (Storm Water Management for Construction Activities) will be applied as a means of complying with Clean Water Act requirements.</p>
<b>Special Waste Authorizations (Alternative 2)</b>					
Dispose of PCB building material	Wastes with PCB concentrations equal to or greater than 50 ppm shall not be authorized for disposal at a landfill.	PCB waste	IAC §567-109.5(2)(c)	Applicable	<p>The buildings contain PCB bulk product waste that will be disposed of off-site. Pursuant to 40 CFR §761.62(b), PCB bulk product waste may be disposed of: (1) using a performance-based disposal; (2) in a solid waste landfill, or (3) using a risk-based disposal. This potential state ARAR does not allow PCB bulk waste with concentrations greater than 50 ppm to be disposed of in a solid waste landfill. Therefore, this potential state ARAR was determined to be more stringent than the potential federal ARAR at 40 CFR § 761.62(b).</p> <p>The PCB bulk product waste will be characterized and if it contains concentrations at or above 50 ppm, it will be disposed of at a TSCA-approved or RCRA hazardous waste landfill. PCB bulk product waste with concentrations below 50 ppm will be disposed of at a solid waste landfill.</p>

TABLE 3 (Continued)

**POTENTIAL STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
<b>ALTERNATIVES</b>					
<b>Building Demolition with Off-site Disposal (Alternative 2)</b>					
<b>Iowa Land Recycling Program and Response Action Standards</b>					
Technological controls	The purpose of a technological control is to effectively sever a pathway by use of technologies such that an applicable receptor could not be exposed to hazardous substances at concentrations above respective applicable target risk levels. Proposal for any technological control as a permanent response action option that would not reduce contaminant concentrations to at or below target risk levels must establish that the pathway to a receptor would be permanently severed or controlled.	A contaminated site enrolled in the Land Recycling Program	IAC § 137.7(1)	Relevant and appropriate	These requirements are not applicable because neither the building nor the site is enrolled in the Land Recycling Program. These requirements are potentially relevant and appropriate to the cover evaluated in Alternative 2 that would be used to prevent exposure to contaminated soil and fill remaining on site.
Impose an IC	The purpose of an IC is to restrict access to or use of an affected area such that current or future receptors could not be exposed to hazardous substances. ICs can include: (1) a state or federal law or regulation, (2) a local ordinance, (3) a recorded contractual obligation, (4) informational devices, or (5) an environmental covenant pursuant to the Uniform Environmental Covenants Act.	A contaminated site enrolled in the Land Recycling Program	IAC § 137.7(2)	Relevant and appropriate	These requirements are not applicable to the ICs under evaluation because neither the building nor the site is enrolled in the Land Recycling Program. These requirements are potentially relevant and appropriate for establishing the ICs necessary to prevent human health exposure to contaminated soil and fill remaining on site.

TABLE 3 (Continued)

**POTENTIAL STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
<b>ALTERNATIVES</b>					
<b>Building Demolition with Off-site Disposal (Alternative 2)</b>					
Modify or terminate an IC or technological control	A participant or owner of property subject to an IC may seek approval from the department for removal, discontinuance, modification, or termination of an IC.	A contaminated site enrolled in the Land Recycling Program	IAC § 137.7(8)	Relevant and appropriate	These requirements are not applicable to the ICs under evaluation because neither the building nor the site is enrolled in the Land Recycling Program. These requirements are potentially relevant and appropriate for modifying or terminating ICs imposed on the site to prevent exposure to contaminated building debris remaining on site.
<b>Uniform Environmental Covenants Act</b>					
Prohibit future uses of or activities at the site	Land use and activity restrictions must be described and embodied in an environmental covenant recorded in every county in which any portion of the real property subject to the environmental covenant is located.	A land use or activity restriction necessary to prevent exposure to contamination	Title XI, Iowa Code, Chapter 455I	Applicable	Land use and activity restrictions are necessary to prevent exposure to contaminated building debris remaining on site, and to maintain the integrity of the final cover.

TABLE 3 (Continued)

**POTENTIAL STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
<b>ALTERNATIVES</b>					
<b>Building Demolition with On-site Containment (Alternative 3)</b>					
<b>Clean Water Act</b>					
Building demolition and construction of covers	Construction activities that disturb 1 acre or more must use best management practices to control stormwater discharges.	Construction activities that affect 1 acre or more	Clean Water Act § 1342 40 CFR §122.44(k)(2) and (4)	Applicable	Building demolition and construction of the covers will affect more than 1 acre, so the storm water discharge requirements are applicable. Best management practices will be used to control storm water discharge to nearby surface water bodies. Pursuant to CERCLA § 121(e), permits are not required for the portions of the remedial action that occur entirely on site. The storm water discharge will occur entirely on site; therefore, a permit to discharge the storm water is not required. However, the substantive provisions of Iowa General Permit 2 (Storm Water Management for Construction Activities) will be used as a means of complying with Clean Water Act requirements.
<b>Special Waste Authorizations (Alternative 3)</b>					
Dispose of PCB building material	Wastes with PCB concentrations equal to or greater than 50 ppm shall not be authorized for disposal at a landfill.	PCB waste	IAC §567-109.5(2)(c)	Applicable	<p>The buildings contain PCB bulk product waste that will be disposed of off-site. Pursuant to 40 CFR §761.62(b), PCB bulk product waste may be disposed of: (1) using a performance-based disposal; (2) in a solid waste landfill, or (3) using a risk-based disposal. This potential state ARAR does not allow PCB bulk waste with concentrations greater than 50 ppm to be disposed of in a solid waste landfill. Therefore, this potential state ARAR was determined to be more stringent than the potential federal ARAR at 40 CFR § 761.62(b).</p> <p>The PCB bulk product waste will be characterized and if it contains concentrations at or above 50 ppm, it will be disposed of at a TSCA-approved or RCRA hazardous waste landfill. PCB bulk product waste with concentrations below 50 ppm will be disposed under the RCRA cap in the southern portion of the site.</p>

TABLE 3 (Continued)

**POTENTIAL STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
<b>ALTERNATIVES</b>					
<b>Building Demolition with On-site Containment (Alternative 3)</b>					
<b>Iowa Land Recycling Program and Response Action Standards</b>					
Technological controls	The purpose of a technological control is to effectively sever a pathway by use of technologies such that an applicable receptor could not be exposed to hazardous substances at concentrations above respective applicable target risk levels. Proposal for any technological control as a permanent response action option that would not reduce contaminant concentrations to at or below target risk levels must establish that the pathway to a receptor would be permanently severed or controlled.	A contaminated site enrolled in the Land Recycling Program	IAC § 137.7(1)	Relevant and appropriate	These requirements are not applicable because neither the building nor the site is enrolled in the Land Recycling Program. These requirements are potentially relevant and appropriate to the cover evaluated in Alternative 3 that would be used to prevent exposure to contaminated building debris remaining on site.
Impose an IC	The purpose of an IC is to restrict access to or use of an affected area such that current or future receptors could not be exposed to hazardous substances. ICs can include: (1) a state or federal law or regulation, (2) a local ordinance, (3) a recorded contractual obligation, (4) informational devices, or (5) an environmental covenant pursuant to the Uniform Environmental Covenants Act.	A contaminated site enrolled in the Land Recycling Program	IAC § 137.7(2)	Relevant and appropriate	These requirements are not applicable to the ICs under evaluation because neither the building nor the site is enrolled in the Land Recycling Program. These requirements are potentially relevant and appropriate for establishing the ICs necessary to prevent human health exposure to contaminated building debris remaining on site.

TABLE 3 (Continued)

**POTENTIAL STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS  
DES MOINES TCE SITE, DES MOINES, IOWA**

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
<b>ALTERNATIVES</b>					
<b>Building Demolition with On-site Containment (Alternative 3)</b>					
Modify or terminate an IC or technological control	A participant or owner of property subject to an IC may seek approval from the department for removal, discontinuance, modification, or termination of an IC.	A contaminated site enrolled in the Land Recycling Program	IAC § 137.7(8)	Relevant and appropriate	These requirements are not applicable to the ICs under evaluation because neither the building nor the site is enrolled in the Land Recycling Program. These requirements are potentially relevant and appropriate for modifying or terminating ICs imposed on the site to prevent exposure to contaminated building debris remaining on site.
<b>Uniform Environmental Covenants Act</b>					
Prohibit future uses of or activities at the site	Land use and activity restrictions must be described and embodied in an environmental covenant recorded in every county in which any portion of the real property subject to the environmental covenant is located.	A land use or activity restriction necessary to prevent exposure to contamination	Title XI, Iowa Code, Chapter 455I	Applicable	Land use and activity restrictions are necessary to prevent exposure to contaminated building debris remaining on site, and to maintain the integrity of the final cover.

Notes:

IAC            *Iowa Administrative Code*  
ppm            Parts per million

## **5.0 DEVELOPMENT OF REMEDIAL ALTERNATIVES**

Tetra Tech evaluated three alternatives addressing buildings and slabs that remain at the site, applying the nine criteria described in CERCLA (EPA 1988). The first alternative, which serves as a baseline, is known as the “No Action” alternative. The second alternative is building demolition with off-site disposal (Figure 6). The third alternative is building demolition with on-site containment that includes crushing building material on site, spreading the material across the site, and covering the fill with a cap (Figures 7 and 8). The following sections describe these alternatives.

### **5.1 ALTERNATIVE 1 – NO ACTION (BASELINE)**

Alternative 1 is the CERCLA-required no-action alternative in which no remediation is undertaken. This alternative does not include additional land use controls, containment, removal, treatment, or other mitigating actions beyond what has already been put in place as a result of the 1996 ROD. It does include continued maintenance of the site as required by the 1996 ROD and 5-year reviews by EPA to evaluate effectiveness. Under Alternative 1, because no action is taken, the site remains unchanged. Building contaminants that pose risk to human health would remain in place. The no action alternative provides a baseline for comparison to the other remedial response alternatives. Alternative 1 would have minimal costs associated with required continued maintenance and 5-year reviews.

### **5.2 ALTERNATIVE 2 – BUILDING DEMOLITION WITH OFF-SITE DISPOSAL**

Alternative 2 includes demolition of all buildings and slab foundations that currently remain on site, and disposal of demolition debris at an off-site landfill. Alternative 2 would include removal of PCB-contaminated insulation and asbestos prior to demolition activities. After demolition activities, areas previously hosting the buildings and slab foundations would be backfilled with non-hazardous debris and capped with asphalt. Assumptions for Alternative 2 are as follows:

1. Collection of an estimated 100 samples is anticipated during the Asbestos Survey. Costs for this survey and report were estimated by application of the “RCRA Facility Investigation” technology in RACER. Assemblies were removed that did not apply.
2. Roofing tar and boiler/piping insulation contain asbestos, and will be abated prior to demolition of buildings. This will be classified as asbestos-containing material (ACM) and disposed of off site as special waste. This includes roofing at the Office Building, Production Building, and Buildings 1, 2, and 3; and boiler/piping insulation at Building 1.
3. The insulation at Buildings 2 and 3 contain PCBs and will be removed prior to demolition of buildings and disposed of in accordance with 40 CFR § 761. Due to the additional restrictions associated with PCB disposal in Iowa, disposal will also be based on concentration as follows:



- a. Insulation and material with PCB concentrations > 50 ppm will be disposed of as bulk product waste at a TSCA-approved and RCRA Subtitle C landfill.
  - b. Non-hazardous waste with PCB concentrations < 50 ppm will be disposed of at a solid waste landfill.
4. The Office Building and Production Building are assumed to have no contamination that can be classified as hazardous waste by 40 CFR § 261 and can therefore be disposed of as non-hazardous waste at a local landfill.
5. The Maintenance Building and Building 4 foundations contain RCRA listed waste and will be disposed of at a TSCA-approved and RCRA Subtitle C landfill.
6. All remaining slab foundations will be removed.
7. During demolition activities, metal materials (i.e. rebar, steel beams, etc.) will be separated and decontaminated. Metals will be recycled at a local scrap yard. It is assumed that the scrap yard will pay \$90 per ton of metal based on current prices as of February 16, 2017.
8. For the purpose of this Focused FS, the following assumptions were made regarding the amount of metal within the structures on site:

Structure	Construction Material	Percent of Structure that Contains Metal
Slab Foundations	Reinforced Concrete	1%
Office Building	Masonry/Concrete	10%
Production Building (76%)	Masonry	10%
Production Building (24 %)	Steel	100%
Building 1	Masonry	10%
Building 2	Masonry	10%
Building 3	Steel	100%
Walkway	Steel	100%

These assumptions are based on review of available photographs of the structures.

9. Demolition debris remaining after the above activities will be sampled to determine if it classifies as a RCRA characteristic waste. For the purposes of this Focused FS, 25 to 75% of the remaining demolition debris is assumed to be RCRA hazardous waste due to RCRA characteristic waste. RCRA hazardous waste will be disposed of at a TSCA-approved and RCRA Subtitle C landfill. All remaining debris determined to be non-hazardous will be used as backfill for excavated slab areas or disposed of at a local landfill.
10. Demolition equipment will require decontamination. Equipment decontamination operations are anticipated to last 1 week. Costs include construction of a decontamination facility pad and disposal of wash water.
11. Disposal of demolition debris containing RCRA listed and characteristic wastes will occur at a TSCA-approved and RCRA Subtitle C landfill in Utah. Transportation by rail and disposal charges will be \$272.58 per ton, based on estimates received from disposal facilities.

12. Disposal of non-hazardous demolition debris will occur at the Metro Park East Landfill in Des Moines, Iowa at a rate of \$38.29 per ton. Transportation by truck to the landfill will be \$21.46 per ton.
13. The volume to weight conversion factor for construction and demolition waste is 0.625 tons per cubic yard based on the Kansas Department of Health and Environment (KDHE) Bureau of Waste Management (KDHE 2010). An Iowa-specific weight conversion was not found.
14. Non-hazardous demolition debris will be used as fill in the building footprints that remain after removal of the buildings and slab foundations. This fill will then be covered with an asphalt cap to prevent exposure to soil that may be contaminated.
15. Asphalt cap repairs will occur every 3 years.
16. ICs will be put in place to prevent exposure to any contamination that remains on site.
17. No soil will be removed as part of this alternative.
18. LDRs are applicable as appropriate.

### **5.3 ALTERNATIVE 3 – BUILDING DEMOLITION WITH ON-SITE CONTAINMENT**

Alternative 3 includes demolishing all buildings that currently remain on-site, crushing the building debris, spreading the debris across the site, and covering the fill with a cap. Slab foundations will remain in place. Building debris will be sampled to determine if it is RCRA characteristic hazardous waste or non-hazardous, and to determine if PCB contamination is present and the concentration. Non-hazardous debris with PCB concentrations < 50 ppm will be spread across the northern and western portions of the site and capped with asphalt. Hazardous debris will be spread across the southern portion of the site under EPA's Area of Contamination (AOC) policy and will include the Maintenance Building and Building 4 slab foundations. The southern portion of the site where hazardous waste is consolidated will be covered with a prescriptive cap following guidelines from EPA's "Technical Guidance Document: Final Covers on Hazardous Waste Landfills and Surface Impoundments" (EPA 1989) and EPA's "(Draft) Technical Guidance for RCRA/CERCLA Final Covers" (EPA 2004). The AOC policy allows that certain discrete areas of generally dispersed contamination may be considered RCRA landfills and would not typically constitute a new act of treatment, storage, or disposal that triggers additional RCRA requirements, like LDRs. Hazardous waste debris that also has PCB concentrations > 50 ppm will be disposed of off site in accordance with 40 CFR § 761. Metals, asbestos, and PCB-contaminated insulation will be removed prior to demolition activities. Assumptions for Alternative 3 are as follows:

1. Collection of an estimated 100 samples is anticipated during the Asbestos Survey. Costs for this survey and report were estimated by application of the "RCRA Facility Investigation" technology in RACER. Assemblies were removed that did not apply.
2. Roofing tar and boiler/piping insulation contain asbestos, and will be abated prior to demolition of buildings. This will be classified as ACM and disposed of off site as special waste. This includes roofing at the Office Building, Production Building, and Buildings 1, 2, and 3; and boiler/piping insulation at Building 1.
3. The insulation at Buildings 2 and 3 contains PCBs and will be removed prior to demolition of buildings and disposed of in accordance with 40 CFR § 761. Due to the additional restrictions associated with PCB disposal in Iowa, disposal will also be based on concentration. Insulation and material with PCB concentrations > 50 ppm will be disposed of as bulk product waste at a TSCA-approved and RCRA Subtitle C landfill.
4. The Office Building and Production Building are assumed to be non-hazardous.
5. The Maintenance Building and Building 4 foundations contain RCRA listed waste.
6. All slab foundations will remain in place.
7. During demolition activities, metal materials (i.e. rebar, steel beams, etc.) will be separated and decontaminated. Metals will be recycled at a local scrap yard. It is assumed that the scrap yard will pay \$90 per ton of metal based on current prices as of February 16, 2017.
8. For the purpose of this Focused FS, the following assumptions were made regarding the amount of metal within the structures on site:

Structure	Construction Material	Percent of Structure that Contains Metal
Office Building	Masonry/Concrete	10%
Production Building (76%)	Masonry	10%
Production Building (24 %)	Steel	100%
Building 1	Masonry	10%
Building 2	Masonry	10%
Building 3	Steel	100%
Walkway	Steel	100%

These assumptions are based on review of available photographs of the structures.

9. Demolition debris remaining after the above activities will be sampled to determine if they are classified as a RCRA characteristic waste. For the purposes of this Focused FS, 25 to 75% of the remaining demolition debris is assumed to be hazardous due to RCRA characteristic waste.
10. Crushed materials will be spread on site and capped. Demolition debris determined to be hazardous will be spread on the southern portion of the site including the area where the foundations remain for the Maintenance Building and Building 4. The prescriptive cap will encompass approximately 3.6 acres and include 2 feet of low permeability clay, 60/1,000-inch (60 mil) high-density polyethylene (HDPE) liner, drainage netting, 36-inch protection layer, 12 inches of top soil, and a vegetative cover. To meet the guidelines for the maximum permeability of clay, 2% sodium bentonite would be added to the clay layer. The non-hazardous demolition debris with PCB concentrations < 50 ppm will be spread across the northern and

western portions of the site, and covered with an asphalt cap encompassing approximately 16.4 acres. The asphalt cap will consist of a 6-inch base course layer and a 3-inch topping that will be placed directly over the demolition debris.

11. Asphalt cap repairs will occur every 3 years.
12. Demolition equipment will require decontamination. Equipment decontamination operations are anticipated to last 1 week. Costs include construction of a decontamination facility pad and disposal of wash water.
13. Disposal of PCB wastes will occur at a TSCA-approved and RCRA Subtitle C landfill in Utah. Transportation by rail and disposal charges will be \$272.58 per ton, based on estimates received from disposal facilities.
14. The volume to weight conversion factor for construction and demolition waste is 0.625 tons per cubic yard based on KDHE Bureau of Waste Management (KDHE 2010). An Iowa-specific weight conversion was not found.
15. ICs will be put in place to prevent exposure to any contamination that remains on site.
16. No soil will be removed as part of this alternative.
17. LDRs are applicable as appropriate.

## **6.0 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES**

This section evaluates remedial alternatives applying EPA guidelines for detailed analysis of alternatives in feasibility studies (EPA 1988). The nine evaluation criteria are also called NCP criteria. The first two are called threshold criteria, the next five are called primary balancing criteria, and the last two are called modifying criteria. The modifying criteria, “state acceptance” and “community acceptance,” are evaluated after receipt of public comment.

### **6.1 ALTERNATIVE 1 – NO ACTION (BASELINE)**

The No Action alternative is required by the NCP and will serve as a comparative reference for other remedial alternatives.

#### **6.1.1 Overall Protection of Human Health and the Environment**

According to the most recent 5-year review of the site (EPA 2013), Alternative 1 was protective of human health regarding contamination in buildings based on industrial land use. However, due to changing land use and the 2013 5-year review, an Ecological Risk Assessment (EPA 2015) and an updated HHRA (Tetra Tech 2017a) were performed. The HHRA addendum identified unacceptable risk to human receptors. Therefore, Alternative 1 is no longer protective of human health or the environment.

#### **6.1.2 Compliance with ARARs**

Alternative 1 does not include an action, and, therefore, requirements to meet ARARs are not triggered by the no action alternative.

#### **6.1.3 Long-Term Effectiveness and Permanence**

Alternative 1 would not be effective in the long term for anticipated future land use, and would not be a permanent remedy. Risk posed by contaminated building materials would remain unmitigated.

#### **6.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment**

Alternative 1 does not include treatment and would therefore not reduce toxicity, mobility, or volume through treatment.

### **6.1.5 Short-Term Effectiveness**

Alternative 1 would not provide any short-term effectiveness, but because it does not include construction, there would be no short-term risk from construction-related activities.

### **6.1.6 Implementability**

Alternative 1 would require minimal effort to implement as it is the current remedy for the site. However, it would face administrative hurdles, because it no longer addresses risk due to the anticipated future use. Potential administrative hurdles would include EPA acceptance of this alternative, updating the current ROD, and 5-year reviews.

### **6.1.7 Cost**

Minimal cost is associated with Alternative 1 for required continued maintenance and 5-year reviews.

### **6.1.8 State Acceptance**

Alternative 1 is the current accepted remedy for the site. However, due to changes in potential land use and potential future development, it is unlikely that Alternative 1 would continue to receive state acceptance because it no longer mitigates risk at the site due to the anticipated future use.

### **6.1.9 Community Acceptance**

Alternative 1 is the current accepted remedy for the site. However, due to changes in land use and potential future development, it is unlikely that Alternative 1 would continue to receive community acceptance because it no longer mitigates risk at the site.

## **6.2 ALTERNATIVE 2 – BUILDING DEMOLITION WITH OFF-SITE DISPOSAL**

Alternative 2 involves removal of building materials, including contaminated materials that contain a RCRA characteristic or listed waste. PCB contaminated insulation and material with PCB concentrations > 50 ppm would be removed from the buildings and disposed of according to 40 CFR § 761 and Iowa regulations. Building materials determined to be non-hazardous with PCB concentrations < 50 ppm could be used as fill in the areas formerly hosting the buildings and slab foundations, followed by an asphalt cap (see Figure 6). All remaining hazardous and non-hazardous waste would be transported to off-site landfills. In addition, the following ICs would be required: (1) prevention of groundwater use beneath the site, (2) installation of vapor intrusion mitigation systems in all buildings constructed on site,

- (3) prevention of activities that would disturb the cap without prior written approval from EPA, and
- (4) disposal of all soil removed from the site would be in accordance with RCRA regulations.

#### **6.2.1 Overall Protection of Human Health and the Environment**

Alternative 2 rates high under this criterion. This alternative permanently reduces long-term risk to human receptors, and restores the area occupied by buildings for anticipated future use. Contaminated material would be disposed of off site. Short-term risk would be mitigated through safe work practices.

#### **6.2.2 Compliance with ARARs**

Alternative 2 would comply with ARARs.

#### **6.2.3 Long-Term Effectiveness and Permanence**

Alternative 2 rates high under this criterion because building materials posing risk would be removed. Contaminated soil would not be addressed by building removal; however risk would be mitigated indirectly through an asphalt cap. Since contamination remains on site, groundwater monitoring would be required. Groundwater monitoring and treatment are ongoing as part of the current ROD for OU1 (EPA 1986). This alternative has a high degree of permanence. Contamination from building materials would not return after removal of the material because the known sources have been removed.

#### **6.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment**

Alternative 2 would reduce the volume of contaminants at the source through off-site disposal in a secure and regulated landfill. Some of the material may also require treatment before disposal, which would reduce toxicity of the material.

#### **6.2.5 Short-Term Effectiveness**

Alternative 2 would have moderate short-term effectiveness. Some risk to workers and the community would be posed during building demolition. Risk to workers would be mitigated through safe work practices, including use of personal protective equipment, dust suppression, and air monitoring. Potential for spill of contaminated material, and increased potential for vehicle collisions due to construction traffic, would be the primary risks to the community.

### 6.2.6 Implementability

Alternative 2 would have high implementability. Technologies and skills necessary to implement the remedy would be readily available. Buildings and foundations could be demolished, crushed, or cut to required sizes and removed with reasonable accuracy. Similarly, non-hazardous demolition debris and asphalt pavement could be used for backfill. Minor site-specific challenges may emerge during demolition and removal. Building demolitions, and removal and placement of fill and an asphalt cap are expected to take 3 months.

### 6.2.7 Cost

The cost of Alternative 2 in 2016 dollars is estimated to be between \$11,608,000 and \$13,226,000 for capital cost depending on the amount of demolition debris determined to be hazardous, \$55,000 for ICs, and \$579,000 for operation and maintenance (O&M) over 30 years. The present value of future O&M is based on an annual discount rate of 7 percent obtained from “A Guide to Developing and Documenting Cost Estimates During the Feasibility Study” (EPA 2000). The estimated cost is sensitive to the volume of building material that must be removed off site and the quantity of building material determined to be hazardous due to RCRA characteristic or listed waste. Details of cost assumptions are presented in Appendix A.

Potential cost savings associated with this alternative are as follows:

- A vegetative cap could be used in place of an asphalt cap for Alternative 2. This would include 18 inches of soil and vegetation and would result in a total potential cost savings of approximately \$1,468,000. The cost for this option is estimated to be between \$10,161,000 and \$11,778,000 for capital cost depending on the amount of demolition debris determined to be hazardous, \$55,000 for ICs, and \$558,000 for O&M over 30 years, assuming an annual discount rate of 7 percent as stated above. The maintenance associated with the asphalt cap, such as seal coating and crack sealing, would be eliminated. However, maintenance for the vegetative cap would be required including re-seeding, fertilization, and erosion repair. Details of cost assumptions are presented in Appendix B.
- If redevelopment of the site was to occur immediately following demolition activities, it could be assumed that no cap would be required over areas where the slab foundations were removed. This would result in a total potential cost savings of approximately \$3,657,000. The cost for this option is estimated to be between \$8,363,000 and \$9,980,000 for capital cost depending on the amount of demolition debris determined to be hazardous, \$55,000 for ICs, and \$167,000 for O&M over 30 years, assuming an annual discount rate of 7 percent as stated above. The asphalt cap and the maintenance associated with the asphalt cap would be removed; however, the volume of non-hazardous waste to be disposed of at an off-site landfill would increase as non-hazardous waste would not be used as fill for the areas formerly hosting the slab foundations. Details of cost assumptions are presented in Appendix B.



- Non-hazardous demolition debris with PCB concentrations < 50 ppm could potentially be disposed of in the SPA instead of off site. This would result in a total potential savings of approximately \$887,000 to \$948,000 for Alternative 2 and approximately \$910,000 for Alternative SP3 for the SPA. Cost saving for the SPA would be due to a reduction in the amount of fill required. Cost savings for Alternative 2, building demolition with off-site disposal, would be due to the volume of debris to be disposed off site. The cost for this option for Alternative 2 is estimated to be between \$10,660,000 to \$12,339,000 for capital cost depending on the amount of demolition debris determined to be hazardous, \$55,000 for ICs, and \$579,000 for O&M over 30 years, assuming an annual discount rate of 7 percent as stated above. Details of cost assumptions are presented in Appendix B.
- Non-hazardous demolition debris with PCB concentrations < 50 ppm could potentially be disposed of on-site in the form of a berm along the edge of the property, approximately 3,615 feet in length. The berm would be approximately 4.5 feet high and would include 3 feet of debris, 18 inches of soil (6 inches each of clay, fill, and topsoil), and a vegetative cover. The berm would be approximately 94 to 110 feet wide, depending on the volume of non-hazardous debris, with a concrete sidewalk, 10 feet wide, for use as a walking path. This alternative provides another option but does not provide significant cost savings. This alternative would result in a potential cost savings of approximately \$24,000 if 75% of the building debris is non-hazardous; however, this alternative would cost approximately \$42,000 more if only 25% of the building debris is non-hazardous. The cost of this option is estimated to be \$11,089,000 for capital cost, \$55,000 for ICs, and \$1,074,000 for O&M over 30 years assuming 75% of the building debris is non-hazardous. The cost of this option is estimated to be \$12,820,000 for capital cost, \$55,000 for ICs, and \$1,027,000 for O&M over 30 years assuming only 25% of the building debris is non-hazardous. Potential additional costs such as drainage design and permitting have not been included. Details of cost assumptions are presented in Appendix B.

#### **6.2.8 State Acceptance**

State acceptance will be evaluated after receipt of public comment.

#### **6.2.9 Community Acceptance**

Community acceptance will be evaluated after receipt of public comment.

### **6.3 ALTERNATIVE 3 – BUILDING DEMOLITION WITH ON-SITE CONTAINMENT**

Alternative 3 involves demolishing the buildings, crushing building debris, and leaving it on site. PCB contaminated insulation and material with PCB concentrations > 50 ppm would be removed from the buildings and disposed of according to 40 CFR 761 and Iowa regulations. All slab foundations would remain in place. Demolition debris determined to be non-hazardous and containing PCB concentrations < 50 ppm would be placed in the northern and western portions of the site and overlain by an asphalt cap (see Figures 7 and 8). The asphalt cap would encompass approximately 16.4 acres and consist of a 6-inch base granular layer and 3-inch hot mix asphalt layer. Approximately 1.6 to 1.8 feet of demolition debris would be used as a foundation layer, depending on the quantity of non-hazardous waste (25-75%).

Demolition debris determined to be hazardous and containing PCB concentrations < 50 ppm would be placed in the southern portion of the site and overlain by a RCRA-compliant cap that would consist of 2 feet of low permeability clay, 60-mil HDPE liner, drainage netting, 36-inch protection layer, 12 inches of top soil, and a vegetative cover (see Figures 7 and 8). This cap would encompass approximately 3.6 acres and would include approximately 0.5 to 1.4 feet of demolition debris as a foundation layer, depending on the quantity of hazardous waste (25-75%). ICs would prevent or control actions that might compromise the remedy or otherwise expose receptors to buried contamination. Shallow groundwater would be monitored if soil-to-groundwater leaching is found to be a concern during the remedial design. In addition, the following ICs would be required: (1) prevention of groundwater use beneath the site, (2) installation of vapor intrusion mitigation systems in all buildings constructed on site, (3) prevention of activities that would disturb the cap without prior written approval from EPA, and (4) disposal of all soil removed from the site would be in accordance with RCRA regulations.

### **6.3.1 Overall Protection of Human Health and the Environment**

Alternative 3 rates moderate to high under this criterion. This alternative reduces long-term risk to human receptors. However, the alternative would require maintenance and implementation of ICs to remain protective. Contaminants in building materials would be contained on site rather than removed. PCBs in building materials, except for insulation, are at concentrations less than 50 ppm, based on results of previous sampling activities. Therefore, material with PCB concentrations < 50 ppm can remain on the site if placed under a cap meeting the requirements of 761.61(a)(7). The already low short-term risk would be further mitigated through safe work practices.

### **6.3.2 Compliance with ARARs**

Alternative 3 would comply with ARARs.

### **6.3.3 Long-Term Effectiveness and Permanence**

Alternative 3 rates moderate to high under this criterion. Burying contaminated building materials under clean fill would isolate it from the environment and human receptors. It is unlikely that natural processes could uncover buried contaminated building material; human actions that could uncover this material would be prohibited or controlled by ICs. The RCRA-compliant caps would limit infiltration of water through contaminated building materials. Leaching from building debris to groundwater is unlikely unless groundwater rises substantially. Since contamination remains on site, groundwater monitoring would be required. Groundwater monitoring and treatment are ongoing as part of the current ROD for

OUI (EPA 1986). As indicated by this monitoring, pesticide contamination in soil and fill below the buildings has not migrated to groundwater over the last few decades. The caps would erode and settle over time and would require periodic grade correction to maintain their function. The caps would be designed to limit leaching. As such, this alternative would protect groundwater in the longterm.

#### **6.3.4 Reduction of Toxicity, Mobility, or Volume through Treatment**

Alternative 3 does not involve treatment and therefore would not reduce toxicity, mobility, or volume of contaminants through treatment.

#### **6.3.5 Short-Term Effectiveness**

Alternative 3 rates moderate to high for short-term effectiveness. Potential for exposure of workers or the community to contaminated building materials would be small because most material would be left on site. There would be some potential for community exposure when asbestos, PCBs, and metals are removed from the site for disposal/recycling. Increased risk of vehicular collisions would be posed because of construction traffic, removal of some building material, and transport of clean fill and asphalt to the site.

#### **6.3.6 Implementability**

Alternative 3 rates moderately high for implementability. The remedy is straightforward, but may require specialized equipment such as bulldozers and backhoes to crush building debris. It would take approximately 4 months to implement. Alternative 3 involves demolishing buildings, removing metals, crushing concrete for fill, and installing RCRA-compliant caps.

#### **6.3.7 Cost**

The cost of Alternative 3 in 2016 dollars is estimated at \$15,321,000 for capital cost, \$55,000 for ICs, and \$1,247,000 for O&M for 30 years. The present value of future O&M is based on an annual discount rate of 7 percent obtained from “A Guide to Developing and Documenting Cost Estimates During the Feasibility Study” (EPA 2000). The estimated cost is sensitive to the design of the cap and the associated repairs. The location of the on-site disposal may vary from that depicted in Figures 7 and 8 due to redevelopment. However, any costs associated with changing the location of the disposal would be the responsibility of the future developer. Details of cost assumptions are presented in Appendix A.

Potential cost savings associated with this alternative are as follows:

- A vegetative cap could be used in place of an asphalt cap for Alternatives 3. This would include 18 inches of soil and vegetation and would result in a total potential cost savings of approximately \$3,096,000. The cost for this option is estimated to be \$12,380,000 for capital cost, \$55,000 for ICs, and \$1,092,000 for O&M for 30 years, assuming a 7 percent discount rate as stated above. The maintenance associated with the asphalt, such as seal coating and crack sealing, would be eliminated. However, maintenance for the vegetative cap would be required including re-seeding, fertilization, and erosion repair. Details of cost assumptions are presented in Appendix B.
- Non-hazardous demolition debris with PCB concentrations < 50 ppm could potentially be disposed of in the SPA instead of spread across the site. This would result in a total potential savings of approximately \$2,087,000 for Alternative 3 and approximately \$910,000 for Alternative SP3 for the SPA. Cost saving for the SPA would be due to a reduction in the amount of fill required. Cost savings for Alternative 3, building demolition with on-site containment, would be due to a reduction in the asphalt cap size and seal coating every three years. This is based on the assumption that a 12 acre asphalt cap would be needed in place of the 16.4 acre cap proposed in this report. The cost for this option for Alternative 3 is estimated to be \$13,403,000 for capital cost, \$55,000 for ICs, and \$1,078,000 for O&M over 30 years, assuming an annual discount rate of 7 percent as stated above. Details of cost assumptions are presented in Appendix B.
- Non-hazardous demolition debris with PCB concentrations < 50 ppm could potentially be disposed of on-site in the form of a berm along the edge of the property, approximately 3,615 feet in length. The berm would be approximately 4.5 feet high and would include 3 feet of debris, 18 inches of soil (6 inches each of clay, fill, and topsoil), and a vegetative cover. The berm would be approximately 78.5 feet wide with a concrete sidewalk, 10 feet wide, for use as a walking path. A small asphalt cap, approximately 2.3 acres in size would still be required to cover the slab foundations of Buildings 1, 2, and 3. This alternative would result in a total potential cost savings of approximately \$4,366,000. The cost for this option is estimated to be \$11,277,000 for capital cost, \$55,000 for ICs, and \$925,000 for O&M over 30 years, assuming an annual discount rate of 7 percent as stated above. Potential additional costs such as drainage design and permitting have not been included. Details of cost assumptions are presented in Appendix B.

#### **6.3.8 State Acceptance**

State acceptance will be evaluated after receipt of public comment.

#### **6.3.9 Community Acceptance**

Community acceptance will be evaluated after receipt of public comment.

## 7.0 COMPARISONS OF REMEDIAL ALTERNATIVES ACCORDING TO REGULATORY CRITERIA

Tetra Tech compared the three remedial alternatives detailed in Section 6.0 according to nine regulatory criteria:

1. Overall protection of human health and the environment
2. Compliance with ARARs
3. Long-term effectiveness and permanence
4. Reduction of toxicity, mobility, or volume through treatment
5. Short-term effectiveness
6. Implementability
7. Cost
8. State acceptance
9. Community acceptance.

The results are summarized in Table 4.

**TABLE 4**  
**SUMMARY OF FEASIBILITY OPTIONS**

<b>Nine Criteria</b>	<b>Alt. 1: No Action</b>	<b>Alt. 2: Building Demo with Off-site Disposal</b>	<b>Alt. 3: Building Demo with On-site Containment</b>
1. Protection	No	Yes. Ranks High	Yes. Moderate to High
2. ARARs	No. Does not comply	Yes.	Yes
3. Long-term Effect.	Not effective	Yes. Ranks High	Yes. Moderate to High
4. Reduction of Toxicity	No	Yes.	No. Would not reduce toxicity, mobility
5. Short-term Effect.	Not effective, but no construction risk	Yes. Moderate	Yes. High
6. Implementability	Yes. Minimal effort required	Yes. High	Yes. Moderate to High
7. Cost	Minimal cost	Capital: \$11,608,000 to \$13,226,000 ICs: \$55,000 O&M: \$579,000 Total: \$12,242,000 to \$13,860,000	Capital: \$15,321,000 ICs: \$55,000 O&M: \$1,247,000 Total: \$16,623,000
8. State Acceptance	Unlikely. TBD	TBD	TBD
9. Community Acceptance	Unlikely. TBD	TBD	TBD

Notes:

TBD            To be determined

Based on results of this Focused FS, No Action (Alternative 1) no longer complies with many of the nine criteria because it does not actively seek to reduce or eliminate risk to human health and the environment based on changes in land use and potential for future development of the site. It is the least expensive because minimal effort would be required to implement.

Building demolition with on-site containment (Alternative 3) satisfies many of the nine criteria, but is the most expensive and does not reduce the volume of contamination on site as much as Alternative 2.

Building demolition with off-site disposal (Alternative 2) satisfies more of the nine criteria, including reducing the volume of contamination on site and potentially reducing the toxicity of COCs, and is less expensive than Alternative 3.

Details of cost assumptions are presented in Appendix A. Figures 6, 7, and 8 show conceptual models of the remedial alternatives—Alternatives 2 and 3. State and community acceptance are not known and could influence stakeholder decision-making.

## **8.0 SUMMARY AND CONCLUSIONS**

Tetra Tech was tasked by EPA under EPA START 4 Contract No. EP-S7-13-06, Task Order No. 0144 to update—by addendum—the Des Moines TCE FS to prepare a Focused FS of removal of buildings and foundations. The site is in south-central Des Moines on the east side of the Raccoon River. The property is owned by Dico, and contamination at the site resulted mainly from Dico’s operations over 40 years that included steel wheel manufacturing, and chemical and pesticide formulation.

Pesticides detected in the Maintenance Building and Building 4 are RCRA listed wastes because of Dico’s previous regulated activities of pesticide formulation.

Tetra Tech evaluated three remedial alternatives: (1) “No Action,” which is the baseline alternative; (2) removing all building materials, with the debris sent offsite to a regulated disposal facility; and (3) demolishing the buildings, crushing all building debris that would then be left on site, spreading the material across the site, and covering the fill with a cap. Details of these remedial alternatives are presented in Section 6.0. Remedial alternatives were compared to nine regulatory criteria in Section 7.0.

Based on results of this Focused FS, No Action (Alternative 1) no longer complies with many of the nine criteria because it does not actively protect human health and the environment based on changes in anticipated future land use. It is the least expensive because minimal effort would be required to implement.

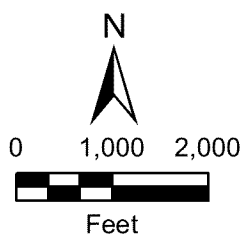
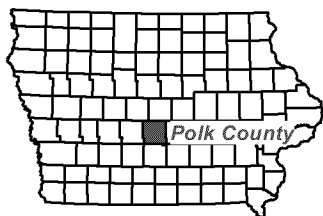
Building demolition with on-site containment (Alternative 3) satisfies many of the nine criteria, but is the most expensive. Building demolition with off-site disposal (Alternative 2) satisfies more of the nine criteria, including reducing the volume of contamination on site and toxicity of COCs, and is less expensive than Alternative 3.

## 9.0 REFERENCES

- Black & Veatch Special Projects Corp. 1996. Final Feasibility Study for the Des Moines TCE Site Operable Unit Nos. 2 and 4, Des Moines, Iowa. May 30.
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- EPA. 2012. PCB Bulk Product Waste Reinterpretation. Office of Resource Conservation and Recovery. October 24.
- EPA. 2013. Fifth Five Year Review Report, Des Moines TCE Superfund Site, Des Moines, Polk, County, Iowa. April 9.
- EPA. 2015. Ecological Risk Assessment for Des Moines TCE Site, Operable Unit 04. October.
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## **FIGURES**



Des Moines TCE Site  
Des Moines, Iowa

**Figure 1**  
Site Location Map



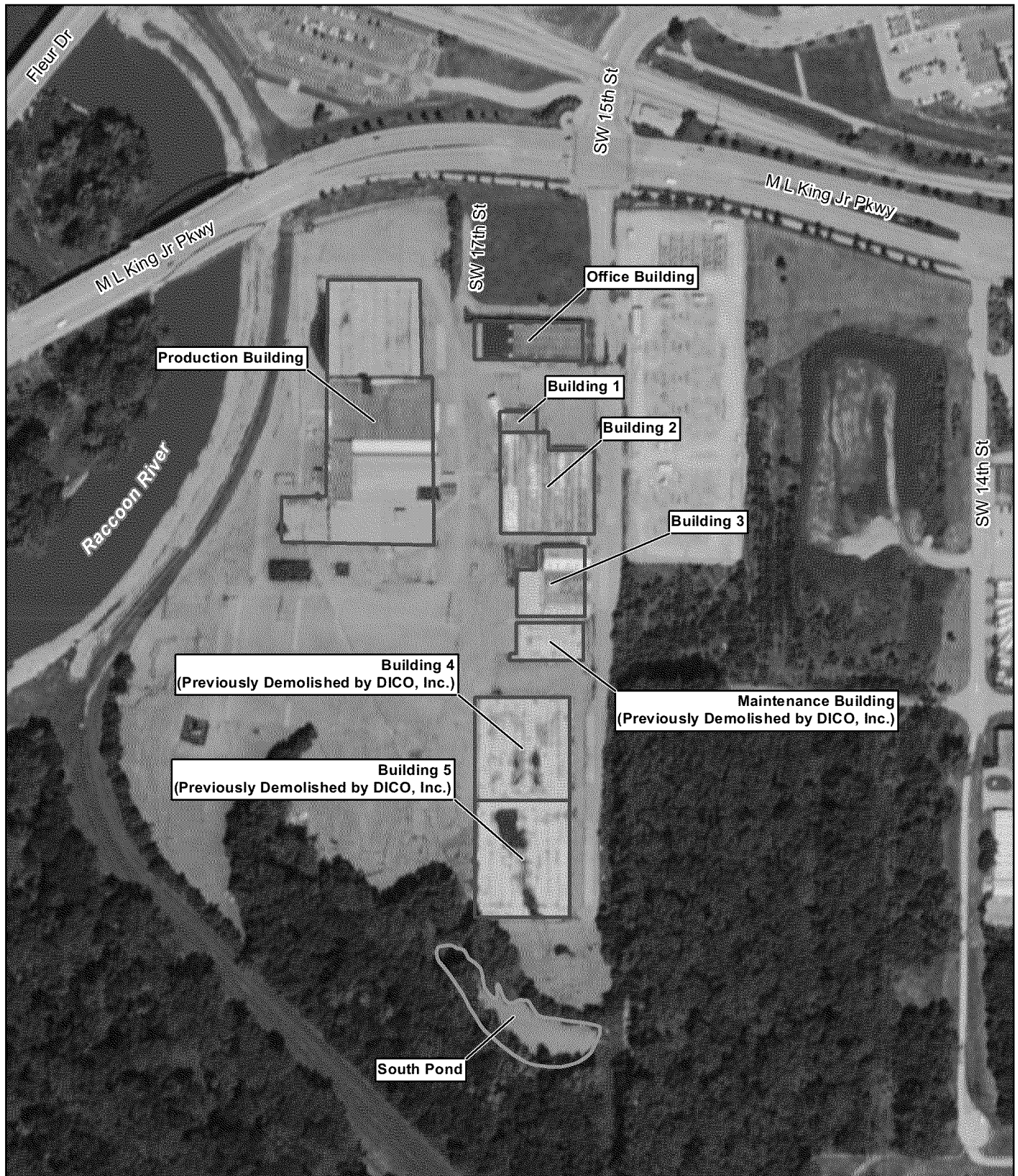
Source: USGS Des Moines SW, IA 7.5 Minute Topo Quad, 1976  
USGS Des Moines SE, IA 7.5 Minute Topo Quad, 1976

Date: 9/29/2016



Drawn By: Nick Wiederholt

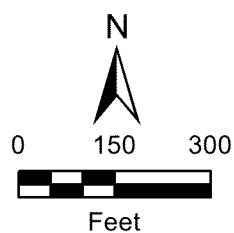
Project No: X9025.16.0144.000





**Legend**

-  Building location
-  South pond area



Des Moines TCE Site  
Des Moines, Iowa

**Figure 2**  
**Site Layout Map**



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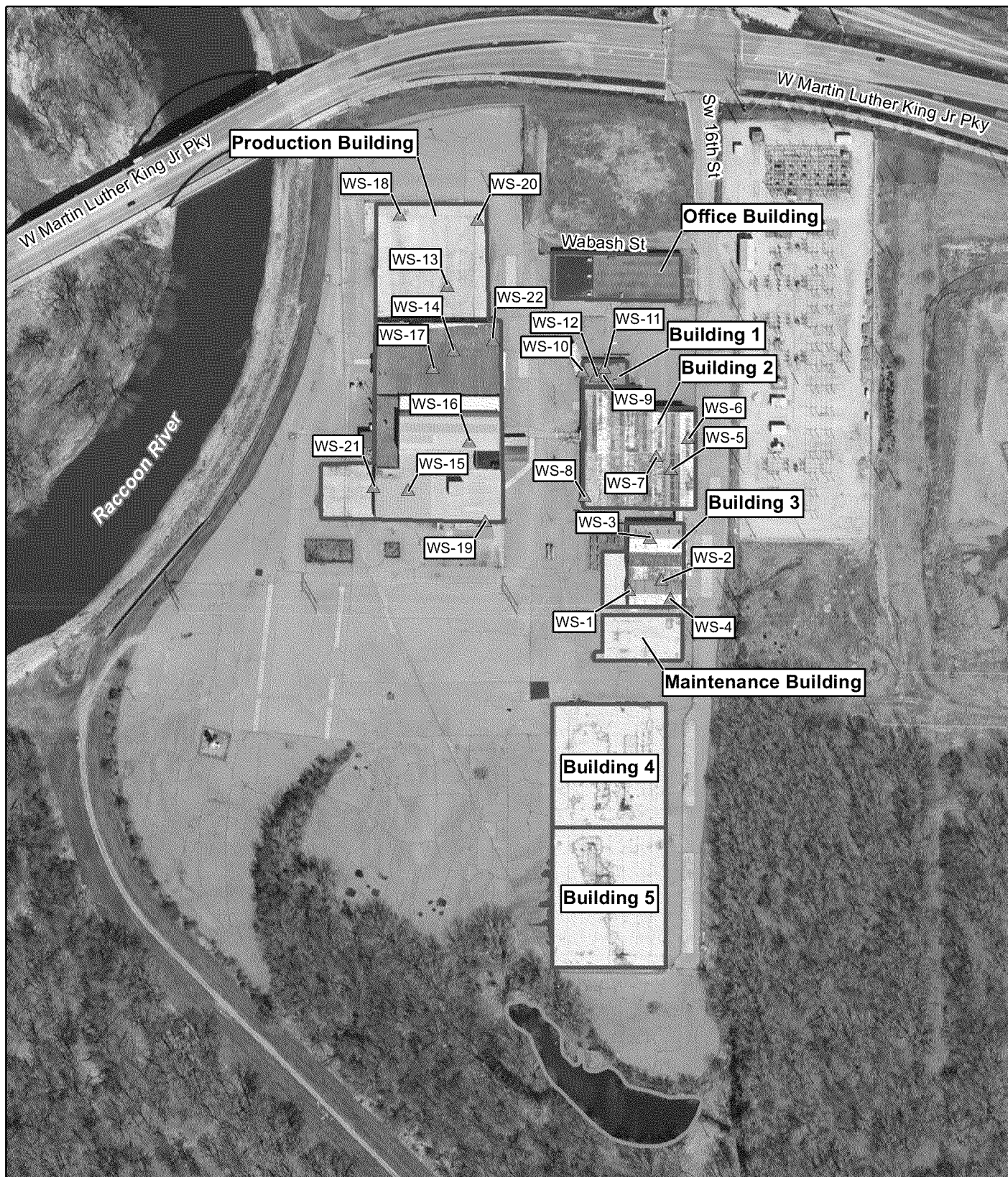
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Date: 12/8/2016




Drawn By: Michelle Handley

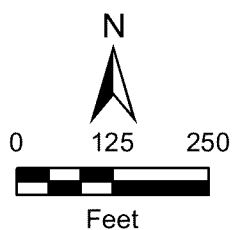
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#### Legend

-  Wipe sample location
-  Building location
-  South pond location



Des Moines TCE Site  
Des Moines, Iowa

**Figure 3**  
Wipe Sample Location Map



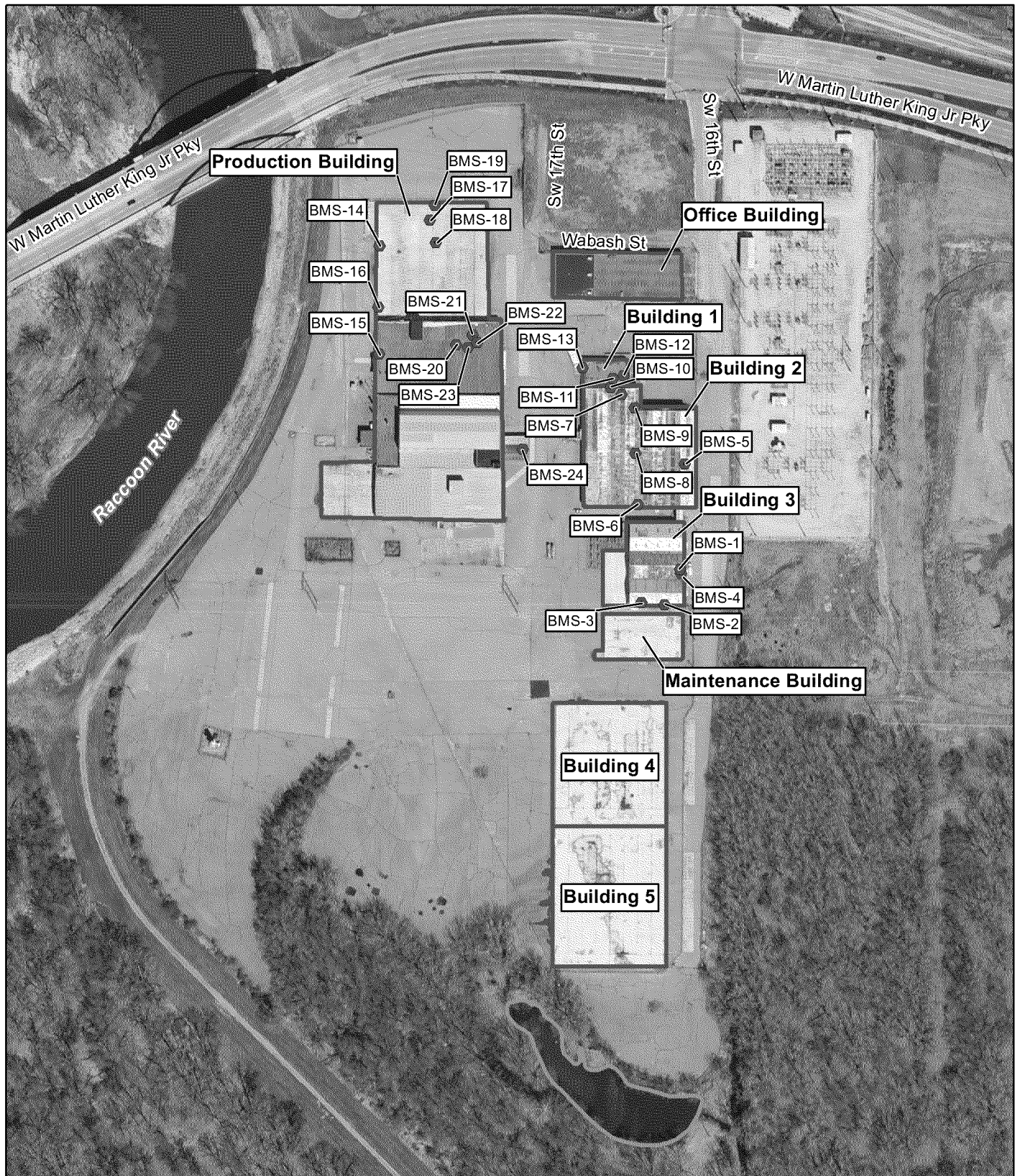
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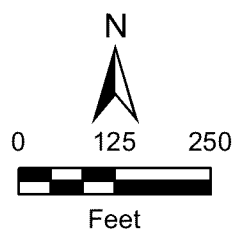
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#### Legend

- Building material sample location
- Building location
- South pond location



Des Moines TCE Site  
Des Moines, Iowa

**Figure 4**  
Building Material Sample Location Map



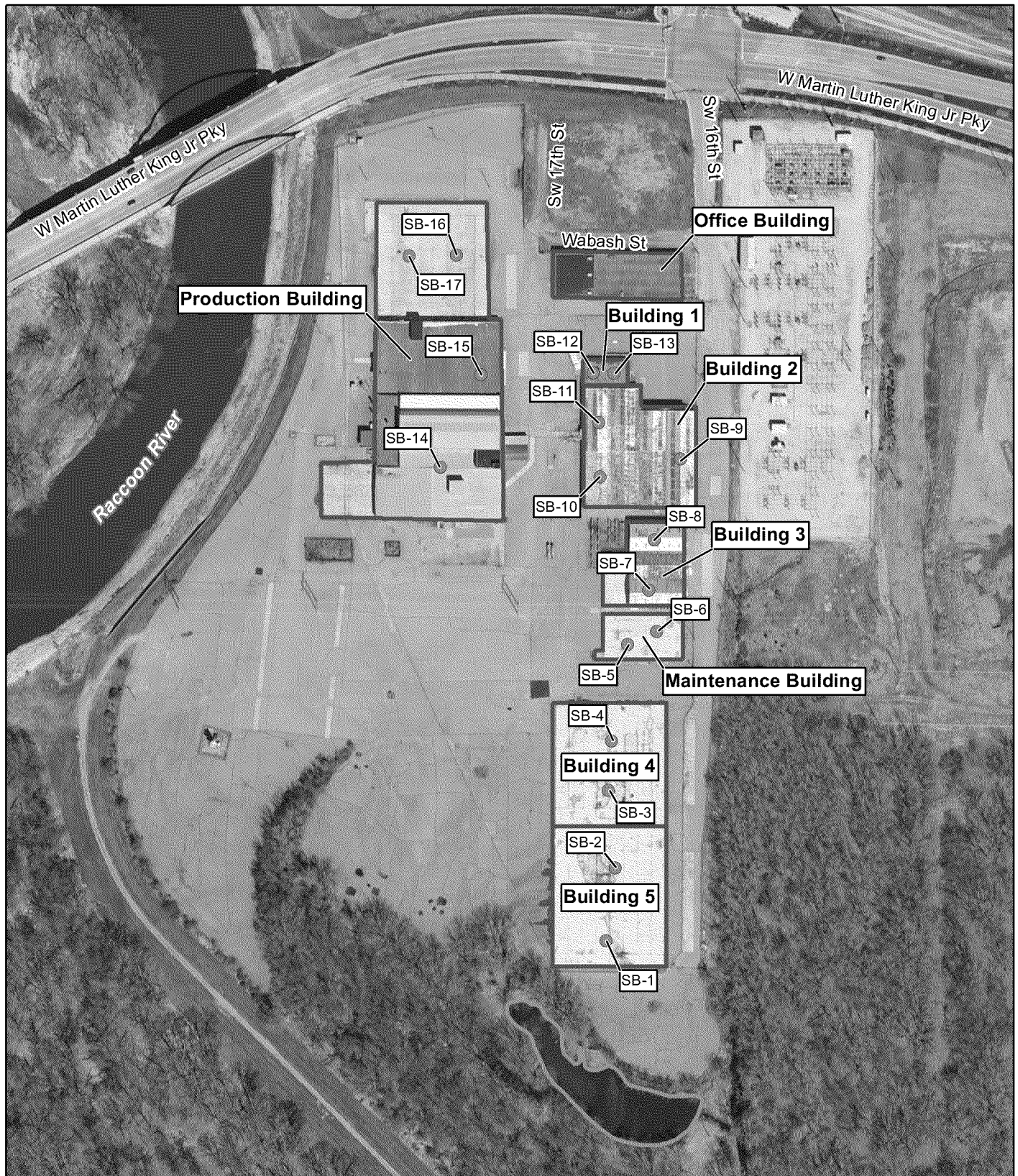
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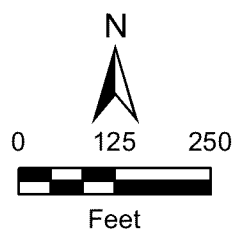
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#### Legend

- Concrete/sub-slab soil sample location
- ▭ Building location
- ▭ South pond location



Des Moines TCE Site  
Des Moines, Iowa

**Figure 5**  
Boring and Concrete  
Sample Location Map

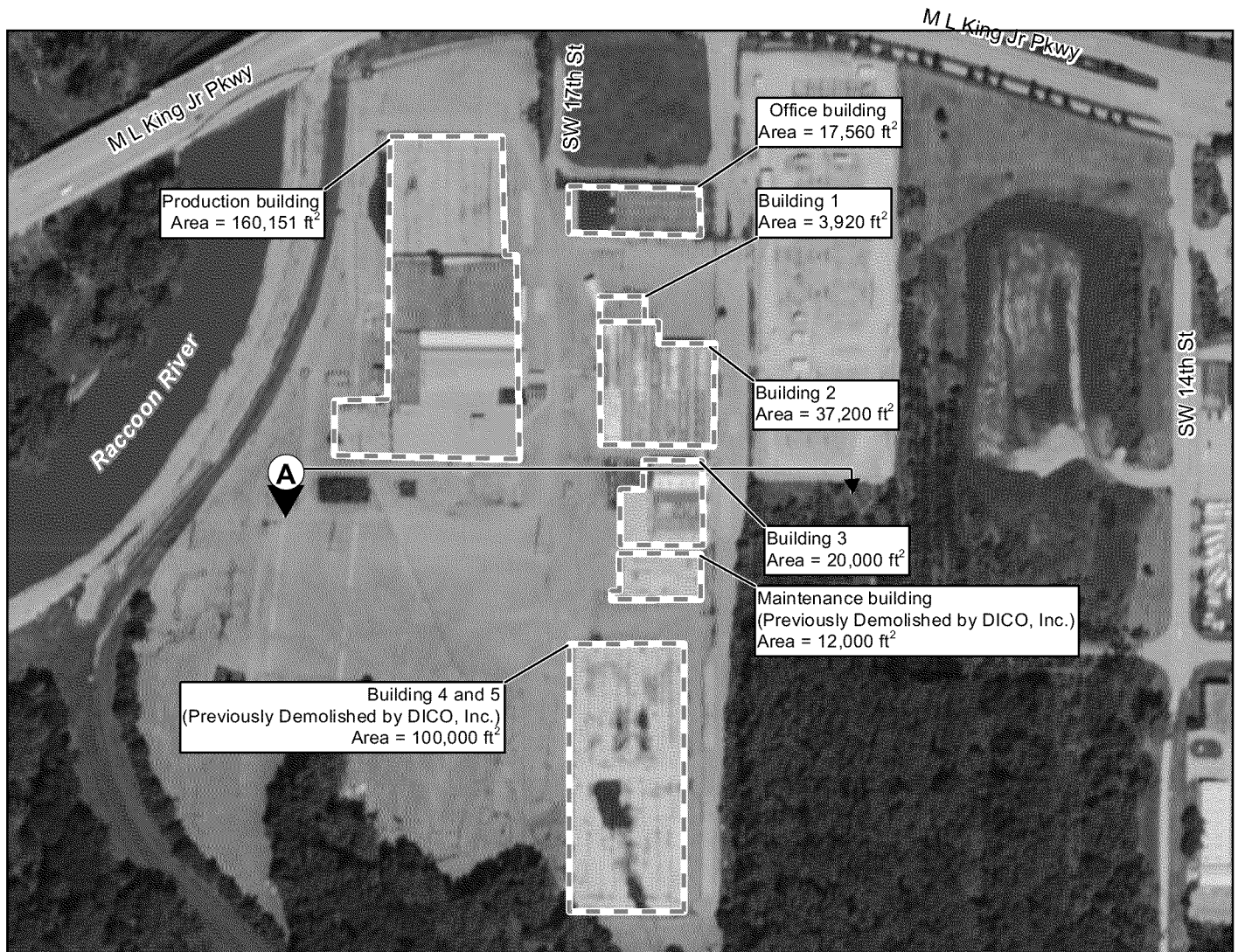


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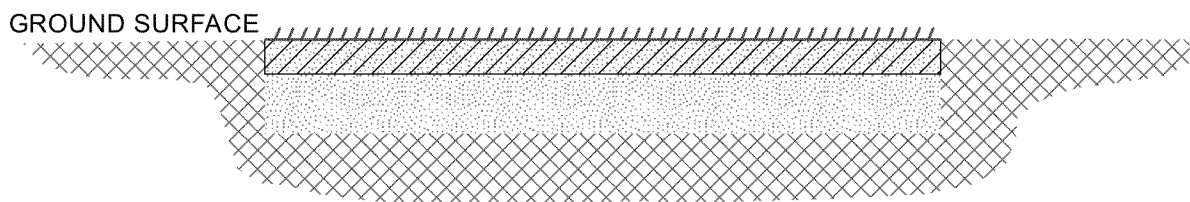
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Project No: X9025.16.0144.000



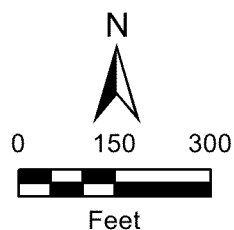
### SECTION A: BUILDING DEMOLITION WITH OFF-SITE DISPOSAL



SECTION A  
NOT TO SCALE

#### Legend

- Asphalt cover (3 inches)
- Base granular layer (6 inches)
- Non-hazardous building debris
- Native soil
- Footprint of building demolition
- ft<sup>2</sup> Square feet



Des Moines TCE Site  
Des Moines, Iowa

**Figure 6**  
Alternative 2 - Building Demolition with Off-Site  
Disposal Cross-Section



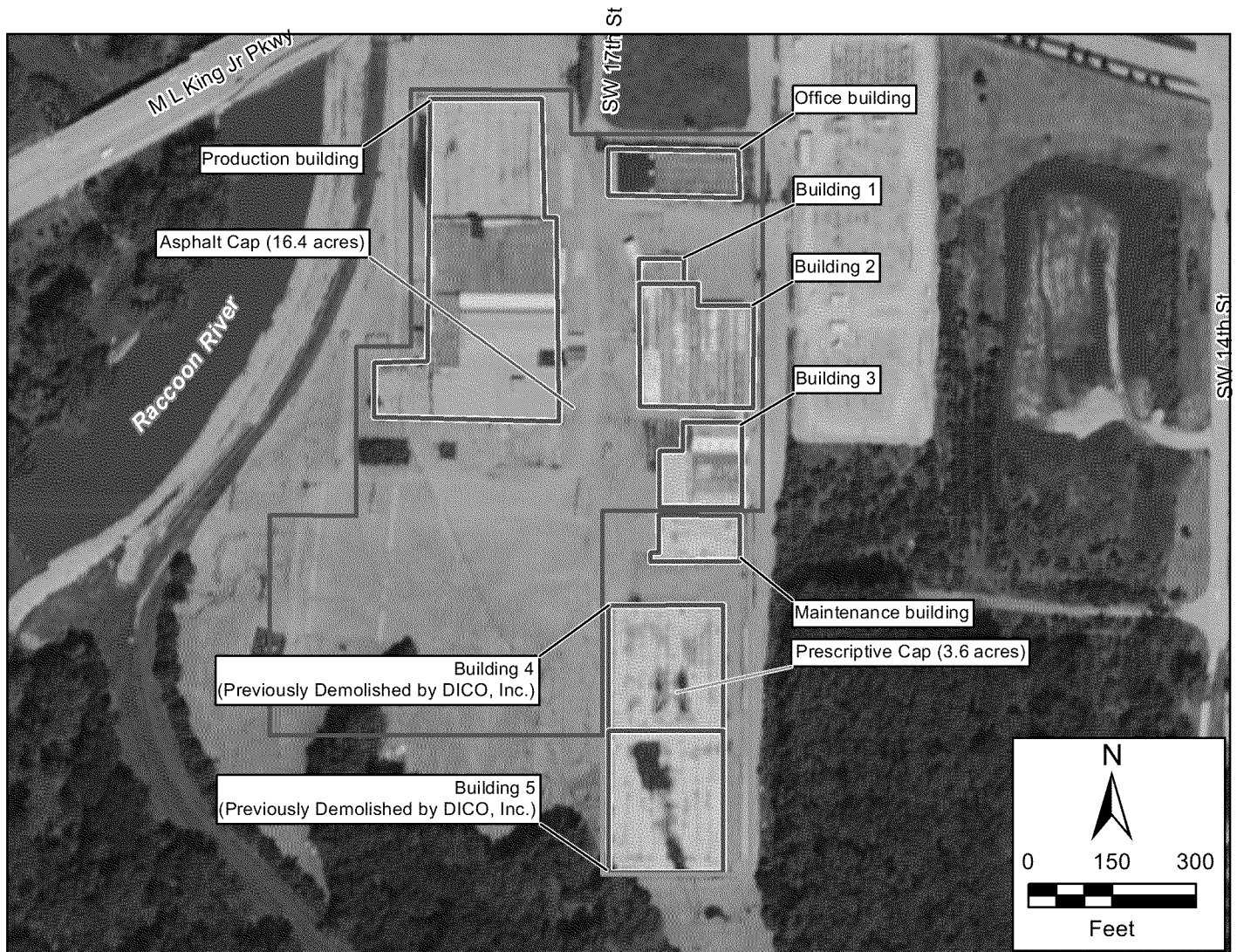
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Date: 2/15/2017

Drawn By: Clayton Hayes

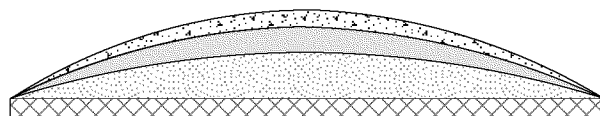
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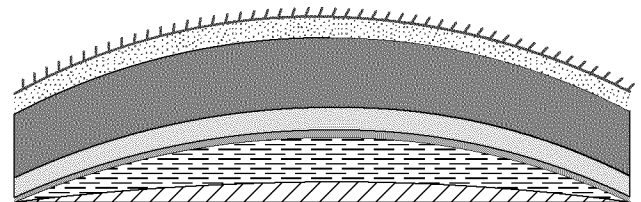
# SECTION A: BUILDING DEMOLITION WITH ON-SITE CONTAINMENT (25% HAZARDOUS)

ASPHALT CAP



NOT TO SCALE

PRESCRIPTIVE CAP



NOT TO SCALE

## Legend

- |   |                                       |
|---|---------------------------------------|
| Vegetative cover                          | Prescriptive Cap                      |
| Footprint of building                     | Topsoil (12 inches)                   |
| Proposed Asphalt Cap                      | Protective layer (36 inches)          |
| Proposed Prescriptive Cap                 | Drainage netting (12 inches)          |
| Asphalt Cap                               | HDPE liner (60 millimeters)           |
| Asphalt cover (3 inches)                  | Clay (2 feet)                         |
| Base granular layer (6 inches)            | Hazardous building debris (~0.5 feet) |
| Non-hazardous building debris (~1.8 feet) | ~ Approximate                         |
| Existing asphalt/concrete                 |                                       |

Source: ESRI, ArcGIS Online Maps, World Imagery, 2014; HSIP Gold, 2007

Des Moines TCE Site  
Des Moines, Iowa

## Figure 7

Alternative 3 - Building Demolition with On-Site  
Containment Cross-Section (25% Hazardous)

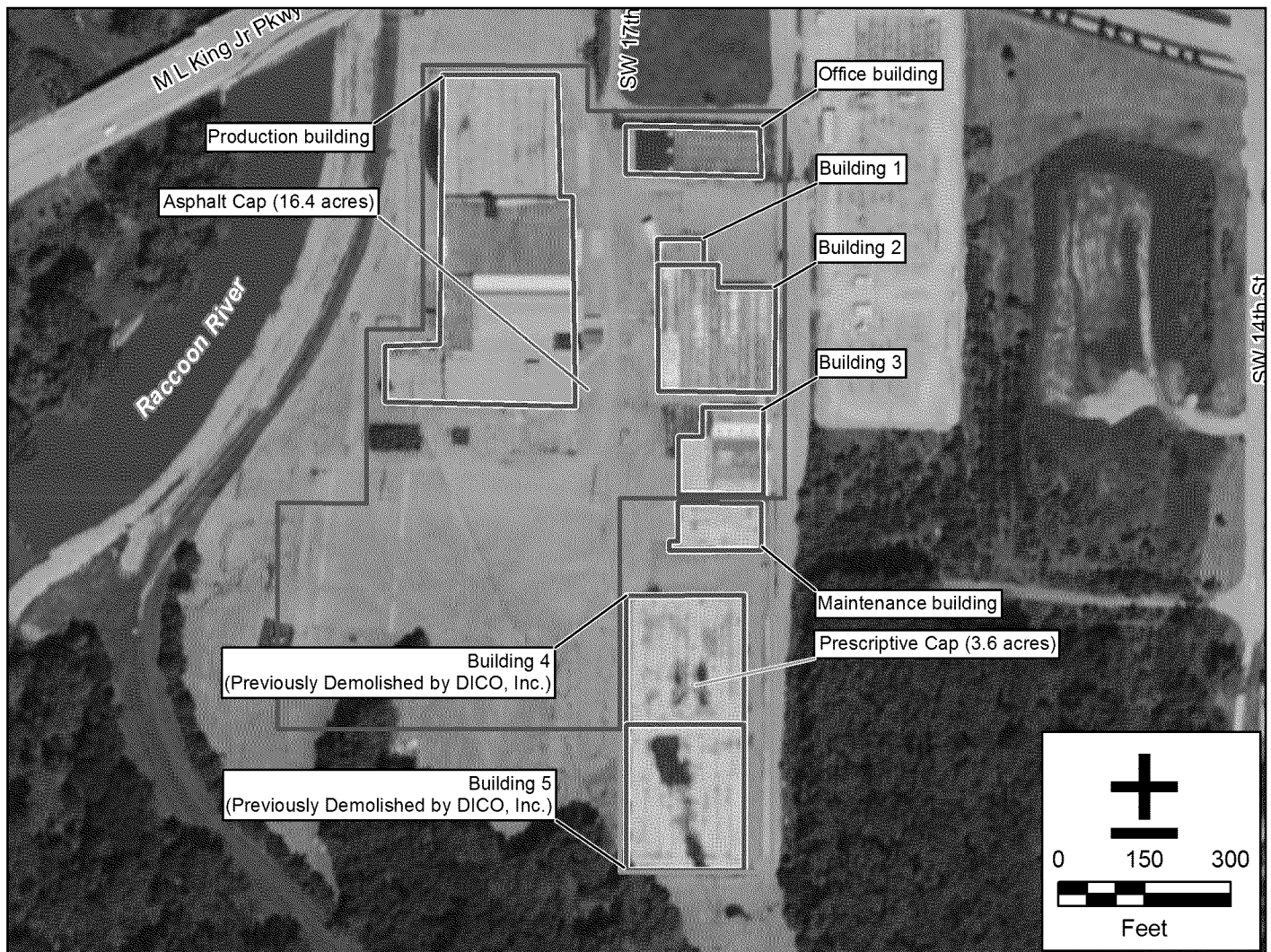


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Drawn By: Clayton Hayes

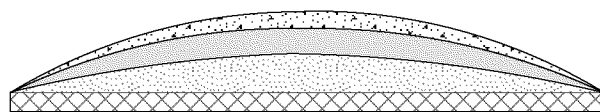
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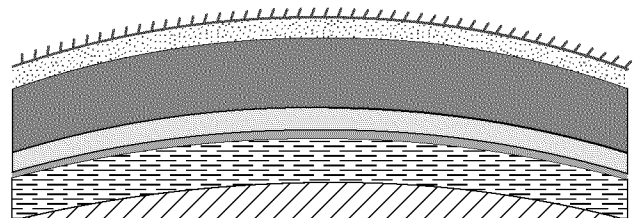
# SECTION A: BUILDING DEMOLITION WITH ON-SITE CONTAINMENT (75% HAZARDOUS)

## ASPHALT CAP



NOT TO SCALE

## PRESCRIPTIVE CAP



NOT TO SCALE

### Legend

- |   |                                       |
|---|---------------------------------------|
| Vegetative cover                          | Prescriptive Cap                      |
| Footprint of building                     | Topsoil (12 inches)                   |
| Proposed Asphalt Cap                      | Protective layer (36 inches)          |
| Proposed Prescriptive Cap                 | Drainage netting (12 inches)          |
| Asphalt Cap                               | HDPE liner (60 millimeters)           |
| Asphalt cover (3 inches)                  | Clay (2 feet)                         |
| Base granular layer (6 inches)            | Hazardous building debris (~1.4 feet) |
| Non-hazardous building debris (~1.6 feet) | ~ Approximate                         |
| Existing asphalt/concrete                 |                                       |

Source: ESRI, ArcGIS Online Maps, World Imagery, 2014; HSIP Gold, 2007

Des Moines TCE Site  
Des Moines, Iowa

### Figure 8

Alternative 3 - Building Demolition with On-Site  
Containment Cross-Section (75% Hazardous)



TETRA TECH

Date: 2/15/2017

Drawn By: Clayton Hayes

Project No: X9025.16.0144.000

## **BUILDING SAMPLE RESULT TABLES**

**WIPE SAMPLE ANALYTICAL DATA SUMMARY - PESTICIDES PCBs**ED\_001521C\_00000077-00061

TABLE BUILDING 1 (Continued)

WIPE SAMPLE ANALYTICAL DATA SUMMARY - PESTICIDES PCBs

Boring		WS-13		WS-14		WS-15		WS-16		WS-17		WS-18		WS-19		WS-19		WS-20		WS-21		WS-22		WS-22	
Sample		Production Building - North Central Concrete		Center of Building Concrete		Production Building - South Central Concrete		Production Building - Central Easter I-Beam		Production Building - Central I-Beam		Production Building - NW Corner I-Beam		Production Building - SE Corner Sheet Metal		Production Building - SE Corner Sheet Metal		Production Building - NW Corner Sheet Metal		Production Building - Central Eastern Brick		Production Building - SW Corner Brick		Production Building - SW Corner Brick	
Chemical	Units	Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result	
ALDRIN	µg/cm²	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	µg/cm²	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U
ALPHA ENDOSULFAN	µg/cm²	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U
ALPHA-CHLORDANE	µg/cm²	0.00075	J	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	µg/cm²	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U
BETA ENDOSULFAN	µg/cm²	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U
Chlordane; Gamma-	µg/cm²	0.00083	J	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	µg/cm²	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U
DIELDRIN	µg/cm²	0.0028	J	< 0.0010	U	0.0039	J	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U
ENDOSULFAN SULFATE	µg/cm²	0.0012	J	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U
ENDRIN	µg/cm²	0.0013	J	0.0025	J	0.0062	J	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U
ENDRIN ALDEHYDE	µg/cm²	0.0018	J	0.0023	J	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U
ENDRIN KETONE	µg/cm²	0.0016	J	0.0026	J	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U
GAMMA BHC (LINDANE)	µg/cm²	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U
HEPTACHLOR	µg/cm²	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U
HEPTACHLOR EPOXIDE	µg/cm²	0.00070		0.00052	J	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U	< 0.00050	U
METHOXYCHLOR	µg/cm²	0.0064	J	< 0.0050	U	0.040	J	< 0.0050	U	< 0.0050	U	< 0.0050	U	< 0.0050	U	< 0.0050	U	< 0.0050	U	< 0.0050	U	< 0.0050	U	< 0.0050	U
P,P'-DDD	µg/cm²	< 0.0010	U	< 0.0010	U	0.0027	J	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U
P,P'-DDE	µg/cm²	0.0026	J	0.0047	J	0.0027	J	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U
P,P'-DDT	µg/cm²	0.0012	J	0.0063	J	0.0028	J	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	< 0.0010	U	0.0035		0.0028	
PCB-1016 (AROCLOR 1016)	µg/cm²	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U
PCB-1221 (AROCLOR 1221)	µg/cm²	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U
PCB-1232 (AROCLOR 1232)	µg/cm²	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U
PCB-1242 (AROCLOR 1242)	µg/cm²	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U
PCB-1248 (AROCLOR 1248)	µg/cm²	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U
PCB-1254 (AROCLOR 1254)	µg/cm²	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	0.016	J	< 0.010	U	< 0.010	U	0.012		< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U
PCB-1260 (AROCLOR 1260)	µg/cm²	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U	< 0.010	U
TOXAPHENE	µg/cm²	< 0.050	U	< 0.050	U	< 0.050	U	< 0.050	U	< 0.050	U	< 0.050	U	< 0.050	U	< 0.050	U	< 0.050	U	< 0.050	U	< 0.050	U	< 0.050	U

Notes:

Highlighted value indicates a positive result.

- µg/cm²
- Dichlorodiphenyldichloroethane
- DDE
- Dichlorodiphenyldichloroethene
- DDT
- Dichlorodiphenyltrichloroethane
- PCB
- Polychlorinated biphenyl
- U
- Non-detect
- J
- Estimated



TABLE BUILDING 2																																																	
BUILDING MATERIAL SAMPLES ANALYTICAL DATA SUMMARY - PESTICIDES PCBs																																																	
Boring	BMS-01		BMS-02		BMS-03		BMS-04		BMS-05		BMS-06		BMS-07		BMS-08		BMS-09		BMS-10		BMS-11		BMS-12		BMS-13		BMS-14		BMS-15		BMS-16		BMS-17		BMS-18		BMS-19		BMS-20		BMS-21		BMS-22		BMS-23		BMS-24		
Sample	Building 3 - Center East Brick Wall	Building 3 - Center South Insulation Wall	Building 3 - SW Corner Cinder Block	Building 3 - Center East Wall Coating	Building 2 - Center East Brick Wall	Building 2 - Center South Wall Insulation	Building 2 - Center North Wall Cinder Block	Building 2 - Center Coating	Building 2 - North Room Dry Wall	Building 1 - South Brick Wall	Building 1 - Center of Building Insulation	Building 1 - East Wall Dry Wall	Building 1 - West Wall Coating	Production Building - NW Corner Brick	Production Building - NW Corner Brick	Production Building - West Wall Cinder Block	Production Building - North Wall Insulation	Production Building - Center of North Dry Wall	Production Building - Center of North Insulation	Production Building - Center of Building Brick	Production Building - Center of Building Coating	Production Building - Wall Insulation	Production Building - Center of Building Wood Wall	Production Building - Southeastern Wood Building																									
SAMPLE_TYPE_CODE	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N			
Chemical	Units	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	
ALDRIN	µg/cm²	< 1.7	U	17	< 17000	U	750	< 17	U	9.0	63	710	320	< 1.7	U	< 6.2	U	< 1.7	U	200	< 1.7	U	14	J	< 1.7	U	9.6	< 2.0	U	< 5.2	U	< 1.7	U	440	6.8	J	4.1	J	< 2.0	UJ									
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	µg/cm²	< 1.7	U	< 8.7	U	< 17000	U	< 50	U	< 17	U	< 5.1	U	< 1.7	U	< 6.2	U	< 1.7	U	< 52	U	< 1.7	U	< 1.7	U	< 1.7	U	< 5.2	U	< 2.0	U	< 5.2	U	< 1.7	U	< 49	U	< 4.9	U	3.0	J	< 2.0	U						
ALPHA ENDOSULFAN	µg/cm²	< 1.7	U	< 8.7	U	< 17000	U	< 50	U	< 17	U	7.8	5.9	150	14	< 1.7	U	9.2	< 1.7	U	270	J	< 1.7	U	6.5	J	2.1	< 5.2	U	< 2.0	U	< 5.2	U	< 1.7	U	400	29	J	< 1.8	U	< 2.0	U							
ALPHA-CHLORDANE	µg/cm²	4.9	88	780000	2500	680	26	26	180	99	8.8	11	< 1.7	U	1500	< 1.7	U	21	J	6.6	12	7.5	7.4	< 1.7	U	< 49	U	< 4.9	U	< 1.8	UJ	12																	
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	µg/cm²	< 1.7	U	< 8.7	U	< 17000	U	130	< 17	U	9.4	< 1.7	U	160	19	< 1.7	U	6.2	3.0	93	< 1.7	U	20	J	4.4	J	< 5.2	U	< 2.0	U	7.6	5.9	230	J	35	J	9.8	J	5.1	J									
BETA ENDOSULFAN	µg/cm²	< 3.4	U	64	< 33000	U	540	< 33	U	13	< 3.4	U	110	12	< 3.3	U	< 12	U	< 3.3	U	350	J	< 3.3	U	11	J	< 3.3	U	< 10	U	< 3.9	U	< 10	U	< 3.3	U	180	J	37	J	17	J	7.4	J					
Chlordane; Gamma-	µg/cm²	7.6	73	860000	3600	750	60	60	530	190	11	25	7.5	1800	< 1.7	U	20	J	6.8	J	12	7.0	12	< 1.7	U	710	J	< 4.9	UJ	< 1.8	UJ	11	J																
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	µg/cm²	< 1.7	U	8.7	< 17000	U	< 50	U	< 17	U	< 5.1	U	< 1.7	U	< 51	U	< 2.0	U	< 1.7	U	< 6.2	U	< 1.7	U	< 52	U	< 1.7	U	< 1.7	U	< 5.2	U	< 2.0	U	< 5.2	U	< 1.7	U	< 49	U	13	J	4.2	J	< 2.0	U			
DIELDRIN	µg/cm²	12	110	150000	6700	150	99	140	1600	710	18	49	15	1600	J	< 3.3	U	28	J	9.3	24	< 3.9	U	35	< 3.3	U	890	J	48	J	9.8	J	10	J															
ENDOSULFAN SULFATE	µg/cm²	< 3.4	U	68	< 33000	U	220	< 33	U	< 10	U	< 3.4	U	< 100	U	< 3.9	U	< 3.3	U	38	< 3.3	U	< 100	U	< 3.3	U	16	J	14	J	< 10	U	< 3.9	U	< 10	U	< 3.3	U	< 95	U	76	J	150	< 3.9	U				
ENDRIN	µg/cm²	< 3.4	U	< 17	U	< 33000	U	400	< 33	U	24	5.9	260	28	6.1	< 12	U	8.7	490	J	< 3.3	U	20	J	4.1	< 10	U	< 3.9	U	13	3.9	220	190	J	< 3.6	U	31	J											
ENDRIN ALDEHYDE	µg/cm²	< 3.4	U	< 17	U	< 33000	U	350	< 33	U	14	< 3.4	U	130	25	< 3.3	U	< 12	U	< 3.3	U	440	J	< 3.3	U	22	J	28	J	< 10	U	< 3.9	U	13	< 3.3	U	22000	J	160	J	120	17	J						
ENDRIN KETONE	µg/cm²	< 3.4	U	21	< 33000	U	480	< 33	U	< 10	U	5.2	240	35	< 3.3	U	< 12	U	< 3.3	U	260	5.1	< 3.3	U	61	< 10	U	< 3.9	U	11	< 3.3	U	< 95	U	340	J	< 3.6	U	6.7	J									
GAMMA BHC (LINDANE)	µg/cm²	< 1.7	U	< 8.7	U	< 17000	U	62	< 17	U	< 5.1	U	< 1.7	U	< 51	U	6.4	< 1.7	U	< 6.2	U	< 1.7	U	< 52	U	< 1.7	U	< 1.7	U	< 5.2	U	< 2.0	U	< 5.2	U	< 1.7	U	< 49	U	11	J	16	J	< 2.0	UJ				
HEPTACHLOR	µg/cm²	< 1.7	U	< 8.7	U	54000	340	46	6.3	11	170	100	< 1.7	U	< 6.2	U	< 1.7	U	280	J	< 1.7	U	6.0	J	< 1.7	U	< 5.2	U	< 2.0	U	< 5.2	U	< 1.7	U	< 49	U	< 4.9	U	< 1.8	U	< 2.0	U							
HEPTACHLOR EPOXIDE	µg/cm²	< 1.7	U	30	24000	180	< 17	U	18	20	210	22	< 1.7	U	35	4.8	390	< 1.7	U	< 1.7	U	< 1.7	U	7.6	< 2.0	U	13	< 1.7	U	390	J	12	J	4.6	J	8.9	J												
METHOXYCHLOR	µg/cm²	< 17	U	< 87	U	< 170000	U	1300	< 170	U	< 51	U	< 17	U	< 510	U	< 20	U	< 17	U	< 62	U	< 17	U	< 520	UJ	< 17	U	35	J	< 17	U	< 52	U	< 20	U	< 52	U	< 17	U	< 490	U	580	J	120	J	< 20	U	
P,P'-DDD	µg/cm²	< 3.4	U	< 17	U	< 33000	U	290	< 33	U	< 10	U	< 3.4	U	< 100	U	17	< 3.3	U	14	3.4	890	J	< 3.3	U	< 3.3	U	< 3.3	U	< 10	U	< 3.9	U	< 10	U	< 3.3	U	230	J	< 9.6	U	47	J	< 3.9	U				
P,P'-DDE	µg/cm²	< 3.4	U	21	35000	1100	< 33	U	40	37	1300	99	16	230	41	6900	< 3.3	U	13	J	5.0	10	< 3.9	U	< 10	U	< 3.3	U	420	89	J	41	J	19	J														
P,P'-DDT	µg/cm²	3.5	45	< 33000	U	260	< 33	U	22	21	970	39	11	72	14	6800	< 3.3	U	16	J	3.8	J	< 10	U	< 3.9	U	< 10	U	< 3.3	U	1500	J	100	J	110	96	J												
PCB-1016 (AROCLOR 1016)	µg/cm²	< 34	UJ	< 170	U	< 33000	U	< 970	U	< 33	U	< 100	U	< 34	U	< 1000	U	< 39	U	< 33	U	< 120	U	< 33	U	< 1000	U	< 33	U	< 33	U	< 33	U	< 100	U	< 39	U	< 100	U	< 33	U	< 950	U	< 96	U	< 36	U	< 39	U
PCB-1221 (AROCLOR 1221)	µg/cm²	< 34	U	< 170	U	< 33000	U	< 970	U	< 33	U	< 100	U	< 34	U	< 1000	U	< 39	U	< 33	U	< 120	U	< 33	U	< 1000	U	< 33	U	< 33	U	< 33	U	< 100	U	< 39	U	< 100	U	< 33	U	< 950	U	< 96	U	< 36	U	< 39	U
PCB-1232 (AROCLOR 1232)	µg/cm²	< 34	U	< 170	U	< 33000	U	< 970	U	< 33	U	< 100	U	< 34	U	< 1000	U	< 39	U	< 33	U	< 120	U	< 33	U	< 1000	U	< 33	U	< 33	U	< 33	U	< 100	U	< 39	U	< 100	U	< 33									

TABLE BUILDING 3

CONCRETE SAMPLES ANALYTICAL DATA SUMMARY - PESTICIDES PCBs

Boring		SB-01		SB-02		SB-03		SB-04		SB-05		SB-06		SB-07		SB-08		SB-09		SB-10		SB-10		SB-11		SB-12		SB-13		SB-14		SB-15		SB-16		SB-17	
Sample		South bldg. 5 - SB-01 Concrete		North bldg. 5 - SB-02 Concrete		South bldg. 4 - SB-03 Concrete		North bldg. 4 - SB-04 Concrete		West maintenance bldg. - SB-05 Concrete		East maintenance bldg. - SB-06 Concrete		South bldg. 3 - SB-07 Concrete		North bldg. 3 - SB-08 Concrete		East bldg. 2 - SB-09 Concrete		West bldg. 2 - SB-10 Concrete		West Bldg. 2 - SB-10 Concrete		North bldg. 2 - SB-11 Concrete		North Bldg 1 - SB-12 Concrete		South bldg. 1 - SB-13 Concrete		Production Building - SB-14 Concrete		Production Building - SB-15 Concrete		Production Building - SB-16 Concrete		Production Building - SB-17 Concrete	
Chemical	Units	Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result		Result	
ALDRIN	µg/cm <sup>2</sup>	130	J	850		510		540		640		420		840		16000		1600		160		67		1000		< 34	U	55		150		41		7.6		400	
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	µg/cm <sup>2</sup>	< 1.7	U	< 17	U	< 17	U	< 17	U	< 17	U	< 8.5	U	< 17	U	< 340	U	< 17	U	< 1.7	U	< 1.7	U	< 17	U	< 34	U	< 8.5	U	< 1.7	U	< 17	U	< 1.7	U	< 8.5	U
ALPHA ENDOSULFAN	µg/cm <sup>2</sup>	< 1.7	U	< 17	U	< 17	U	< 17	U	< 17	U	< 8.5	U	< 17	U	< 340	U	< 17	U	1.8		< 1.7	U	< 17	U	< 34	U	< 8.5	U	< 1.7	U	< 17	U	< 1.7	U	< 8.5	U
ALPHA-CHLORDANE	µg/cm <sup>2</sup>	< 1.7	U	110		54		< 17	U	< 17	U	240		89		< 340	U	40		16		< 1.7	U	44		< 34	U	46		< 1.7	U	< 17	U	< 1.7	U	< 8.5	U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	µg/cm <sup>2</sup>	< 1.7	U	< 17	U	< 17	U	< 17	U	< 17	U	< 8.5	U	< 17	U	< 340	U	< 17	U	< 1.7	U	< 1.7	U	< 17	U	< 34	U	< 8.5	U	< 1.7	U	< 17	U	< 1.7	U	< 8.5	U
BETA ENDOSULFAN	µg/cm <sup>2</sup>	< 3.3	U	< 33	U	< 33	U	< 33	U	< 32	U	< 16	U	< 33	U	< 660	U	< 33	U	3.5		< 3.3	U	< 32	U	< 65	U	< 16	U	< 3.3	U	33		3.6		< 16	U
Chlordane; Gamma-	µg/cm <sup>2</sup>	110		670		250		65		41		400		120		550		220		57		22		130		150		53		< 1.7	UJ	28		< 1.7	U	9.1	
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	µg/cm <sup>2</sup>	< 1.7	U	< 17	U	< 17	U	< 17	U	< 17	U	< 8.5	U	< 17	U	< 340	U	< 17	U	< 1.7	U	< 1.7	U	< 17	U	< 34	U	< 8.5	U	< 1.7	U	< 17	U	< 1.7	U	< 8.5	U
DIELDRIN	µg/cm <sup>2</sup>	24	J	140		120		74		97		280		210		1700		670		57		31		430		110		130		51	J	37		22		59	
ENDOSULFAN SULFATE	µg/cm <sup>2</sup>	4.4	J	< 33	U	< 33	U	< 33	U	< 32	U	< 16	U	< 33	U	< 660	U	< 33	U	3.6		< 3.3	U	< 32	U	< 65	U	< 16	U	< 3.3	U	< 33	U	< 3.3	U	< 16	U
ENDRIN	µg/cm <sup>2</sup>	< 3.3	U	< 33	U	< 33	U	< 33	U	< 32	U	25		< 33	U	< 660	U	1200		9.0		5.2		< 32	U	< 65	U	< 16	U	33	J	34		3.3		< 16	U
ENDRIN ALDEHYDE	µg/cm <sup>2</sup>	< 3.3	U	< 33	U	< 33	U	< 33	U	< 32	U	< 16	U	< 33	U	< 660	U	< 33	U	4.3		< 3.3	U	< 32	U	< 65	U	23		< 3.3	U	41		9.5		< 16	U
ENDRIN KETONE	µg/cm <sup>2</sup>	3.9	J	< 33	U	< 33	U	< 33	U	< 32	U	< 16	U	< 33	U	< 660	U	< 33	U	< 3.3	U	< 3.3	U	< 32	U	< 65	U	< 16	U	< 3.3	U	34		3.9		< 16	U
GAMMA BHC (LINDANE)	µg/cm <sup>2</sup>	< 1.7	U	< 17	U	< 17	U	< 17	U	< 17	U	< 8.5	U	< 17	U	< 340	U	< 17	U	7.9		< 1.7	U	< 17	U	< 34	U	< 8.5	U	< 1.7	U	< 17	U	< 1.7	U	< 8.5	U
HEPTACHLOR	µg/cm <sup>2</sup>	< 1.7	U	< 17	U	< 17	U	< 17	U	< 17	U	< 8.5	U	< 17	U	< 340	U	< 17	U	2.8		< 1.7	U	34		< 34	U	< 8.5	U	2.1	J	< 17	U	< 1.7	U	< 8.5	U
HEPTACHLOR EPOXIDE	µg/cm <sup>2</sup>	4.5		< 17	U	< 17	U	< 17	U	< 17	U	21		< 17	U	< 340	U	< 17	U	6.9		4.1		25		< 34	U	< 8.5	U	6.2	J	< 17	U	7.7		< 8.5	U
METHOXYCHLOR	µg/cm <sup>2</sup>	< 17	U	< 170	U	< 170	U	< 170	U	< 170	U	< 85	U	290		< 3400	U	< 170	U	26		< 17	U	< 170	U	< 340	U	< 85	U	560	J	< 170	U	< 17	U	< 85	U
P,P'-DDD	µg/cm <sup>2</sup>	< 3.3	U	< 33	U	< 33	U	< 33	U	< 32	U	< 16	U	< 33	U	< 660	U	< 33	U	< 3.3	U	< 3.3	U	< 32	U	< 65	U	< 16	U	64		< 33	U	4.2		< 16	U
P,P'-DDE	µg/cm <sup>2</sup>	8.0	J	< 33	U	< 33	U	< 33	U	< 32	U	41		140		< 660	U	190		47		25		280		10000		930		90		1100		61		38	
P,P'-DDT	µg/cm <sup>2</sup>	< 3.3	U	41		47		< 33	U	< 32	U	19		42	J	< 660	U	< 33	U	5.7		< 3.3	U	40		73		97		45		61		< 3.3	U	20	
PCB-1016 (AROCLOR 1016)	µg/cm <sup>2</sup>	< 33	U	< 33	U	< 33	U	< 33	U	< 32	U	< 33	U	< 33	UJ	< 33	U	< 33	U	< 33	U	< 33	U	< 32	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	UJ	< 33	U
PCB-1221 (AROCLOR 1221)	µg/cm <sup>2</sup>	< 33	U	< 33	U	< 33	U	< 33	U	< 32	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	U	< 32	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	UJ	< 33	U
PCB-1232 (AROCLOR 1232)	µg/cm <sup>2</sup>	< 33	U	< 33	U	< 33	U	< 33	U	< 32	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	U	< 32	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	UJ	< 33	U
PCB-1242 (AROCLOR 1242)	µg/cm <sup>2</sup>	< 33	U	< 33	U	< 33	U	< 33	U	< 32	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	U	< 32	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	UJ	< 33	U
PCB-1248 (AROCLOR 1248)	µg/cm <sup>2</sup>	< 33	U	< 33	U	< 33	U	< 33	U	< 32	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	U	< 32	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	UJ	< 33	U
PCB-1254 (AROCLOR 1254)	µg/cm <sup>2</sup>	< 33	U	< 33	U	< 33	U	< 33	U	< 32	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	U	< 32	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	UJ	< 33	U
PCB-1260 (AROCLOR 1260)	µg/cm <sup>2</sup>	< 33	U	< 33	U	< 33	U	< 33	U	< 32	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	U	< 32	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	UJ	< 33	U
PCB-1262 (AROCHLOR 1262)	µg/cm <sup>2</sup>	< 33	U	< 33	U	< 33	U	< 33	U	< 32	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	U	< 32	U	< 33	U	< 33	U	< 33	U	< 33	U	< 33	UJ	< 33	U
TOXAPHENE	µg/cm <sup>2</sup>	< 170	U	< 1700	U	< 1700	U	< 1700	U	< 1700	U	< 850	U	< 1700	U	< 34000	U	< 1700	U	< 170	U	< 170	U	< 1700	U	< 3400	U	< 850	U	< 170	U	< 1700	U	< 170	U	< 850	U

Notes:

Highlighted values indicate a positive resul

- µg/cm<sup>2</sup>
- DDD
- DDE
- DDT
- PCB
- U
- J
- Micro-grams per centimeter squared
- Dichlorodiphenyldichloroethane
- Dichlorodiphenyldichloroethene
- Dichlorodiphenyltrichloroethane
- Polychlorinated biphenyl
- Non-detect
- Estimated

**APPENDIX A**  
**COST ESTIMATE**

**Appendix A  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa**

TABLE A-1						
COST SUMMARY						
Alternative	Option	Description	Capital Cost	Institutional Controls	Operation & Maintenance	Total
2A	NA	Building Demolition with Off-site Disposal (25% Hazardous)	\$ 11,608,000	\$ 55,000	\$ 579,000	\$ 12,242,000
2B	NA	Building Demolition with Off-site Disposal (75% Hazardous)	\$ 13,226,000	\$ 55,000	\$ 579,000	\$ 13,860,000
3	NA	Building Demolition with On-site Containment (25-75% Hazardous)	\$ 15,321,000	\$ 55,000	\$ 1,247,000	\$ 16,623,000



Appendix A  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

ALTERNATIVE 2A  
BUILDING DEMOLITION WITH OFF-SITE DISPOSAL (25% HAZARDOUS)

Table A-2				
Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)				
Source	Description	Subtotal	Contingency	Total (Rounded)
Table A-3	Design and Construction	\$ 8,929,568	\$ 2,678,870	\$ 11,608,000
Table A-4	Institutional Controls	\$ 42,500	\$ 12,750	\$ 55,000
Table A-5	Operation and Maintenance	\$ 445,676	\$ 133,703	\$ 579,000
Contingency		30%	\$ 2,825,323	
Total			\$	12,242,000

**Appendix A  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa**

**Capital Cost**

Location factor (for zip code 433xx)

ECHOS	1
Get-a-Quote	1.04

Note: Location factor applied only to national average unit costs; not applied to local unit costs such as from vendors or Means.

Overhead and Profit (O&P)

General	25%	Typical general contractor overhead and profit
Means	-	NA
RACER	25%	NA
Contractor quote	5%	Prime contractor markup
Professional judgment	-	Not marked-up

Inflation

2.08%	Avg. annual inflation from 2010 to 2015
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Table A-3					
Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Construction Subtotal</b>				<b>\$ 7,123,309</b>
	<b>Site Preparation</b>				<b>\$ 15,000</b>
1	Temporary facilities	1.0	ls	\$ 15,000.00	\$ 15,000
	<b>Asbestos Survey</b>				<b>\$ 8,703</b>
2	Asbestos survey	1.0	ls	\$ 8,702.50	\$ 8,703
	<b>Equipment Decontamination</b>				<b>\$ 81,685</b>
3	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 69,645.00	\$ 69,645
4	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Asbestos Removal and Disposal</b>				<b>\$ 603,711</b>
5	Asbestos removal - Office Building	1.0	ls	\$ 86,733.75	\$ 86,734
6	Asbestos removal - Production Building	1.0	ls	\$ 170,078.75	\$ 170,079
7	Asbestos removal - Building 1	1.0	ls	\$ 43,548.75	\$ 43,549
8	Asbestos removal - Building 2	1.0	ls	\$ 209,323.75	\$ 209,324
9	Asbestos removal - Building 3	1.0	ls	\$ 94,025.00	\$ 94,025
	<b>PCB Removal and Disposal</b>				<b>\$ 330,886</b>
10	PCB removal - Building 2	1.0	ls	\$ 81,773.75	\$ 81,774
11	PCB removal - Building 3	1.0	ls	\$ 133,537.50	\$ 133,538
12	PCB disposal	424.0	ton	\$ 272.58	\$ 115,574
	<b>Metal Decontamination</b>				<b>\$ 96,478</b>
13	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 84,437.50	\$ 84,438
14	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Building Demolition</b>				<b>\$ 785,685</b>
15	Building demolition - Office Building	1.0	ls	\$ 76,375.84	\$ 76,376
16	Building demolition - Production Building	1.0	ls	\$ 504,541.80	\$ 504,542
17	Building demolition - Building 1	1.0	ls	\$ 14,489.11	\$ 14,489
18	Building demolition - Building 2	1.0	ls	\$ 137,498.69	\$ 137,499
19	Building demolition - Building 3	1.0	ls	\$ 51,387.91	\$ 51,388
20	Building demolition - Walkway	1.0	ls	\$ 1,390.95	\$ 1,391

**Appendix A**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table A-3					
Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Slab Demolition</b>				<b>\$ 529,227</b>
21	Slab demolition - Office Building	1.0	ls	\$ 26,489.16	\$ 26,489
22	Slab demolition - Production Building	1.0	ls	\$ 241,586.65	\$ 241,587
23	Slab demolition - Building 1	1.0	ls	\$ 5,913.90	\$ 5,914
24	Slab demolition - Building 2	1.0	ls	\$ 56,116.11	\$ 56,116
25	Slab demolition - Building 3	1.0	ls	\$ 30,169.46	\$ 30,169
26	Slab demolition - Maintenance Building	1.0	ls	\$ 18,102.16	\$ 18,102
27	Slab demolition - Buildings 4 and 5	1.0	ls	\$ 150,849.76	\$ 150,850
	<b>Waste Characterization</b>				<b>\$ 88,641</b>
28	Sampling and analysis for pesticides, PCBs, and VOCs (building debris and wastewater)	1.0	ls	\$ 88,641.25	\$ 88,641
	<b>Transportation and Disposal</b>				<b>\$ 2,527,559</b>
29	Dump charges (non-hazardous waste)	29,828.0	ton	\$ 38.29	\$ 1,142,130
30	Load and haul (non-hazardous waste)	29,828.0	ton	\$ 21.46	\$ 640,194
31	Transportation and disposal (hazardous)	2,734.0	ton	\$ 272.58	\$ 745,235
	<b>Capping</b>				<b>\$ 1,891,076</b>
32	Asphalt pavement - 6 inch base course layer, 3 inch topping	40,463.0	sy	\$ 46.60	\$ 1,885,576
33	Cap material sampling and analysis (every 500 ft)	2.0	ea	\$ 2,000.00	\$ 4,000
34	Cap thickness verification (every 100 ft)	10.0	ea	\$ 150.00	\$ 1,500
	<b>Crushing</b>				<b>\$ 103,212</b>
35	Bulldozer (crushing non-hazardous debris for fill)	160.0	hr	\$ 267.40	\$ 42,784
36	Backhoe, 0.75 CY (crushing non-hazardous debris for fill)	160.0	hr	\$ 142.55	\$ 22,808
37	Jackhammer (crushing of non-hazardous debris for fill)	160.0	hr	\$ 235.13	\$ 37,620
	<b>Measurement</b>				<b>\$ 61,446</b>
38	Pre-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
39	Post-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
Construction subtotal				\$	7,123,309
Construction Contractor Mobe/Demobe, Site Prep and Submittals				10%	\$ 712,331
Pre-design investigation				10%	\$ 712,331
Engineering design				18%	\$ 1,282,196
Project management and construction oversight				7%	\$ 498,632
Recycling of metal (15,547 tons at \$90 per ton)					\$ (1,399,230)
<b>Capital Cost Subtotal</b>				<b>\$</b>	<b>8,929,568</b>

Appendix A  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

Table A-4					
Institutional Controls					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Institutional Controls Subtotal</b>				<b>\$ 42,500</b>
40	Prepare LUC Implementation Plan (mid-level staff with senior review)	250	hr	\$ 110.00	\$ 27,500
41	Meetings with agencies (senior staff and attorneys)	60	hr	\$ 250.00	\$ 15,000

Operation and Maintenance

Table A-5					
Operation and Maintenance					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Annual Operation and Maintenance Subtotal</b>				<b>\$ 38,149</b>
	<b>Cap Monitoring</b>				<b>\$ 9,500</b>
42	Engineer site visit (1 per year)	1.0	ls	\$ 3,500.00	\$ 3,500
43	Proj. Mgmt. 2 hrs/wk on proj for 24 weeks	48.0	hr	\$ 125.00	\$ 6,000
	<b>Cap Repair (every 3 years)</b>				<b>\$ 70,947</b>
44	Seal coat	364,167.0	sf	\$ 0.17	\$ 62,382
45	Crack sealing	10,000.0	lf	\$ 0.86	\$ 8,565
	<b>Five-Year Review (every 5 years)</b>				<b>\$ 25,000</b>
46	Five-year review	1.0	ls	\$ 25,000.00	\$ 25,000

Notes:  
ea Each  
hr Hour  
lf Linear foot  
ls Lump sum  
sf Square foot  
sy Square yard

Appendix A  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

ALTERNATIVE 2B  
BUILDING DEMOLITION WITH OFF-SITE DISPOSAL (75% HAZARDOUS)

Table A-6				
Alternative 2B - Building Demolition with Off-site Disposal (75% Hazardous)				
Source	Description	Subtotal	Contingency	Total (Rounded)
Table A-7	Design and Construction	\$ 10,173,841	\$ 3,052,152	\$ 13,226,000
Table A-8	Institutional Controls	\$ 42,500	\$ 12,750	\$ 55,000
Table A-9	Operation and Maintenance	\$ 445,676	\$ 133,703	\$ 579,000
Contingency		30%	\$ 3,198,605	
Total			\$	13,860,000

Appendix A  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

Capital Cost

Location factor (for zip code 433xx)

ECHOS	1
Get-a-Quote	1.04

Note: Location factor applied only to national average unit costs; not applied to local unit costs such as from vendors or Means.

Overhead and Profit (O&P)

General	25%	Typical general contractor overhead and profit
Means	-	NA
RACER	25%	NA
Contractor quote	5%	Prime contractor markup
Professional judgment	-	Not marked-up

Inflation 2.08% Avg. annual inflation from 2010 to 2015

Table A-7					
Alternative 2B - Building Demolition with Off-site Disposal (75% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	Construction Subtotal				\$ 7,981,428
	Site Preparation				\$ 15,000
1	Temporary facilities	1.0	ls	\$ 15,000.00	\$ 15,000
	Asbestos Survey				\$ 8,703
2	Asbestos survey	1.0	ls	\$ 8,702.50	\$ 8,703
	Equipment Decontamination				\$ 81,685
3	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 69,645.00	\$ 69,645
4	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	Asbestos Removal and Disposal				\$ 603,711
5	Asbestos removal - Office Building	1.0	ls	\$ 86,733.75	\$ 86,734
6	Asbestos removal - Production Building	1.0	ls	\$ 170,078.75	\$ 170,079
7	Asbestos removal - Building 1	1.0	ls	\$ 43,548.75	\$ 43,549
8	Asbestos removal - Building 2	1.0	ls	\$ 209,323.75	\$ 209,324
9	Asbestos removal - Building 3	1.0	ls	\$ 94,025.00	\$ 94,025
	PCB Removal and Disposal				\$ 330,886
10	PCB removal - Building 2	1.0	ls	\$ 81,773.75	\$ 81,774
11	PCB removal - Building 3	1.0	ls	\$ 133,537.50	\$ 133,538
12	PCB disposal	424.0	ton	\$ 272.58	\$ 115,574
	Metal Decontamination				\$ 96,478
13	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 84,437.50	\$ 84,438
14	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	Building Demolition				\$ 785,685
15	Building demolition - Office Building	1.0	ls	\$ 76,375.84	\$ 76,376
16	Building demolition - Production Building	1.0	ls	\$ 504,541.80	\$ 504,542
17	Building demolition - Building 1	1.0	ls	\$ 14,489.11	\$ 14,489
18	Building demolition - Building 2	1.0	ls	\$ 137,498.69	\$ 137,499
19	Building demolition - Building 3	1.0	ls	\$ 51,387.91	\$ 51,388
20	Building demolition - Walkway	1.0	ls	\$ 1,390.95	\$ 1,391

**Appendix A**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table A-7					
Alternative 2B - Building Demolition with Off-site Disposal (75% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Slab Demolition</b>				<b>\$ 529,227</b>
21	Slab demolition - Office Building	1.0	ls	\$ 26,489.16	\$ 26,489
22	Slab demolition - Production Building	1.0	ls	\$ 241,586.65	\$ 241,587
23	Slab demolition - Building 1	1.0	ls	\$ 5,913.90	\$ 5,914
24	Slab demolition - Building 2	1.0	ls	\$ 56,116.11	\$ 56,116
25	Slab demolition - Building 3	1.0	ls	\$ 30,169.46	\$ 30,169
26	Slab demolition - Maintenance Building	1.0	ls	\$ 18,102.16	\$ 18,102
27	Slab demolition - Buildings 4 and 5	1.0	ls	\$ 150,849.76	\$ 150,850
	<b>Waste Characterization</b>				<b>\$ 88,641</b>
28	Sampling and analysis for pesticides, PCBs, and VOCs (building debris and wastewater)	1.0	ls	\$ 88,641.25	\$ 88,641
	<b>Transportation and Disposal</b>				<b>\$ 3,385,678</b>
29	Dump charges (non-hazardous waste)	25,796.0	ton	\$ 38.29	\$ 987,743
30	Load and haul (non-hazardous waste)	25,796.0	ton	\$ 21.46	\$ 553,656
31	Transportation and disposal (hazardous)	6,766.0	ton	\$ 272.58	\$ 1,844,279
	<b>Capping</b>				<b>\$ 1,891,076</b>
32	Asphalt pavement - 6 inch base course layer, 3 inch topping	40,463.0	sy	\$ 46.60	\$ 1,885,576
33	Cap material sampling and analysis (every 500 ft)	2.0	ea	\$ 2,000.00	\$ 4,000
34	Cap thickness verification (every 100 ft)	10.0	ea	\$ 150.00	\$ 1,500
	<b>Crushing</b>				<b>\$ 103,212</b>
35	Bulldozer (crushing non-hazardous debris for fill)	160.0	hr	\$ 267.40	\$ 42,784
36	Backhoe, 0.75 CY (crushing non-hazardous debris for fill)	160.0	hr	\$ 142.55	\$ 22,808
37	Jackhammer (crushing of non-hazardous debris for fill)	160.0	hr	\$ 235.13	\$ 37,620
	<b>Measurement</b>				<b>\$ 61,446</b>
38	Pre-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
39	Post-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
Construction subtotal					\$ 7,981,428
Construction Contractor Mobe/Demobe, Site Prep and Submittals					\$ 798,142.80
Pre-design investigation					\$ 798,142.80
Engineering design					\$ 1,436,657.04
Project management and construction oversight					\$ 558,699.96
Recycling of metal (15,547 tons at \$90 per ton)					\$ (1,399,230.00)
<b>Capital Cost Subtotal</b>					<b>\$ 10,173,841</b>

Appendix A  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

Table A-8					
Institutional Controls					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	Institutional Controls Subtotal				\$ 42,500
40	Prepare LUC Implementation Plan (mid-level staff with senior review)	250	hr	\$ 110.00	\$ 27,500
41	Meetings with agencies (senior staff and attorneys)	60	hr	\$ 250.00	\$ 15,000

Operation and Maintenance

Table A-9					
Operation and Maintenance					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	Annual Operation and Maintenance Subtotal				\$ 38,149
	Cap Monitoring				\$ 9,500
42	Engineer site visit (1 per year)	1.0	ls	\$ 3,500.00	\$ 3,500
43	Proj. Mgmt. 2 hrs/wk on proj for 24 weeks	48.0	hr	\$ 125.00	\$ 6,000
	Cap Repair (every 3 years)				\$ 70,947
44	Seal coat	364,167.0	sf	\$ 0.17	\$ 62,382
45	Crack sealing	10,000.0	lf	\$ 0.86	\$ 8,565
	Five-Year Review (every 5 years)				\$ 25,000
46	Five-year review	1.0	ls	\$ 25,000.00	\$ 25,000

Notes:

ea	Each
hr	Hour
lf	Linear foot
ls	Lump sum
sf	Square foot
sy	Square yard



Appendix A  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

ALTERNATIVE 3  
BUILDING DEMOLITION WITH ON-SITE CONTAINMENT (25-75% HAZARDOUS)

Table A-10				
Alternative 3 - Building Demolition with On-site Containment (25-75% Hazardous)				
Source	Description	Subtotal	Contingency	Total (Rounded)
Table A-11	Design and Construction	\$ 11,785,301	\$ 3,535,590	\$ 15,321,000
Table A-12	Institutional Controls	\$ 42,500	\$ 12,750	\$ 55,000
Table A-13	Operation and Maintenance	\$ 959,032	\$ 287,710	\$ 1,247,000
Contingency		30%	\$ 3,836,050	
Total				\$ 16,623,000

**Appendix A  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa**

**Capital Cost**

Location factor (for zip code 433xx)

ECHOS	1
Get-a-Quote	1.04

Note: Location factor applied only to national average unit costs; not applied to local unit costs such as from vendors or Means.

Overhead and Profit (O&P)

General	25%	Typical general contractor overhead and profit
Means	-	NA
RACER	25%	NA
Contractor quote	5%	Prime contractor markup
Professional judgment	-	Not marked-up

Inflation 2.08% Avg. annual inflation from 2010 to 2015

Table A-11					
Alternative 3 - Building Demolition with On-site Containment (25-75% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Construction Subtotal</b>				<b>\$ 9,092,780</b>
	<b>Site Preparation</b>				<b>\$ 15,000</b>
1	Temporary facilities	1.0	ls	\$ 15,000.00	\$ 15,000
	<b>Asbestos Survey</b>				<b>\$ 8,703</b>
2	Asbestos survey	1.0	ls	\$ 8,702.50	\$ 8,703
	<b>Equipment Decontamination</b>				<b>\$ 81,685</b>
3	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 69,645.00	\$ 69,645
4	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Asbestos Removal and Disposal</b>				<b>\$ 603,711</b>
5	Asbestos removal - Office Building	1.0	ls	\$ 86,733.75	\$ 86,734
6	Asbestos removal - Production Building	1.0	ls	\$ 170,078.75	\$ 170,079
7	Asbestos removal - Building 1	1.0	ls	\$ 43,548.75	\$ 43,549
8	Asbestos removal - Building 2	1.0	ls	\$ 209,323.75	\$ 209,324
9	Asbestos removal - Building 3	1.0	ls	\$ 94,025.00	\$ 94,025
	<b>PCB Removal and Disposal</b>				<b>\$ 330,886</b>
10	PCB removal - Building 2	1.0	ls	\$ 81,773.75	\$ 81,774
11	PCB removal - Building 3	1.0	ls	\$ 133,537.50	\$ 133,538
12	PCB disposal	424.0	ton	\$ 272.58	\$ 115,574
	<b>Metal Decontamination</b>				<b>\$ 96,478</b>
13	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 84,437.50	\$ 84,438
14	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Building Demolition</b>				<b>\$ 785,685</b>
15	Building demolition - Office Building	1.0	ls	\$ 76,375.84	\$ 76,376
16	Building demolition - Production Building	1.0	ls	\$ 504,541.80	\$ 504,542
17	Building demolition - Building 1	1.0	ls	\$ 14,489.11	\$ 14,489
18	Building demolition - Building 2	1.0	ls	\$ 137,498.69	\$ 137,499
19	Building demolition - Building 3	1.0	ls	\$ 51,387.91	\$ 51,388
20	Building demolition - Walkway	1.0	ls	\$ 1,390.95	\$ 1,391

**Appendix A  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa**

Table A-11					
Alternative 3 - Building Demolition with On-site Containment (25-75% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Waste Characterization</b>				<b>\$ 75,349</b>
21	Sampling and analysis for pesticides, PCBs, and VOCs (building debris and wastewater)	1.0	ls	\$ 75,348.75	\$ 75,349
	<b>Asphalt Cap</b>				<b>\$ 3,833,739</b>
22	Asphalt pavement - 6 inch base course layer, 3 inch topping (includes 1.6-1.8 feet debris foundation layer)	81,915.0	sy	\$ 46.60	\$ 3,817,239
23	Cap material sampling and analysis (every 500 ft)	6.0	ea	\$ 2,000.00	\$ 12,000
24	Cap thickness verification (every 100 ft)	30.0	ea	\$ 150.00	\$ 4,500
	<b>Prescriptive Cap</b>				<b>\$ 2,684,038</b>
25	Seeding, vegetative cover	3.7	ac	\$ 4,993.48	\$ 18,576
26	Topsoil, 12 inches deep	7,504.7	lcy	\$ 51.00	\$ 382,742
27	Fill, 6 inch lifts (includes delivery, spreading, and compaction)	22,514.2	cy	\$ 34.89	\$ 785,465
28	Clay, low permeability, 2 feet (includes 0.5-1.4 feet debris foundation layer)	16,811.0	cy	\$ 37.84	\$ 636,086
29	Drainage netting, geotextile fabric heat-bonded 2 sides	178,312.6	sf	\$ 0.85	\$ 151,566
30	60 Mil polymetric liner, high-density polyethylene	178,312.6	sf	\$ 0.93	\$ 164,939
31	Sodium bentonite flocculant aid	907,773.0	lb	\$ 0.60	\$ 544,664
	<b>Crushing</b>				<b>\$ 516,060</b>
32	Bulldozer (crushing debris for fill)	800.0	hr	\$ 267.40	\$ 213,920
33	Backhoe, 0.75 CY (crushing debris for fill)	800.0	hr	\$ 142.55	\$ 114,040
34	Jackhammer (crushing of debris for fill)	800.0	hr	\$ 235.13	\$ 188,100
	<b>Measurement</b>				<b>\$ 61,446</b>
35	Pre-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
36	Post-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
Construction subtotal					\$ 9,092,780
Construction Contractor Move/Demove, Site Prep and Submittals					\$ 909,278.00
Pre-design investigation					\$ 909,278.00
Engineering design					\$ 1,636,700.40
Project management and construction oversight					\$ 636,494.60
Recycling of metal (15,547 tons at \$90 per ton)					\$ (1,399,230.00)
<b>Capital Cost Subtotal</b>					<b>\$ 11,785,301</b>

Appendix A  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

Table A-12					
Institutional Controls					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Institutional Controls Subtotal</b>				<b>\$ 42,500</b>
37	Prepare LUC Implementation Plan (mid-level staff with senior review)	250	hr	\$ 110.00	\$ 27,500
38	Meetings with agencies (senior staff and attorneys)	60	hr	\$ 250.00	\$ 15,000

Operation and Maintenance

Table A-13					
Operation and Maintenance					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Annual Operation and Maintenance Subtotal</b>				<b>81,610</b>
	<b>Cap and Groundwater Monitoring</b>				<b>\$ 11,140</b>
39	Groundwater sampling (included as part of semi-annual groundwater sampling for Operable Unit 4)	2.0	day	\$ -	\$ -
40	Sample analysis for pesticides (VOCs sampled during semi-annual groundwater sampling for Operable Unit 4)	20.0	ea	\$ 81.99	\$ 1,640
41	Monitoring annual report (included with semi-annual monitoring report for Operable Unit 4)	1.0	ls	\$ -	\$ -
42	Engineer site visit (1 per year)	1.0	ls	\$ 3,500.00	\$ 3,500
43	Proj. Mgmt. 2 hrs/wk on proj for 24 weeks	48.0	hr	\$ 125.00	\$ 6,000
	<b>Asphalt Cap Repair (every 3 years)</b>				<b>\$ 164,830</b>
44	Seal coat	737,235.0	sf	\$ 0.17	\$ 126,288
45	Crack sealing	45,000.0	lf	\$ 0.86	\$ 38,542
	<b>Prescriptive Cap Repair</b>				<b>\$ 10,527</b>
46	Re-seeding (25 percent of cap)	0.9	ac	\$ 4,993.48	\$ 4,619
47	Fertilization	3.7	ac	\$ 921.16	\$ 3,408
48	Erosion repair	1.0	ls	\$ 2,500.00	\$ 2,500
	<b>Five-Year Review (every 5 years)</b>				<b>\$ 25,000</b>
49	Five-year review	1.0	ls	\$ 25,000.00	\$ 25,000

Notes:

ac Acre  
cy Cubic yard  
ea Each  
hr Hour  
lb Pound  
lcy Loose cubic yard  
lf Linear foot  
ls Lump sum  
sf Square foot  
sy Square yard

**Appendix A**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Annual Discount Rate <sup>1</sup>:

30-Yr 7.00%

Table A-14						
Present Value Analysis						
Year	Annual Discount Factor <sup>2</sup>	Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)				
		Operation and Maintenance Costs				
	30-Yr	Description	Future Cost <sup>3</sup>	Description	Future Cost <sup>3</sup>	Present Value (2015)
0	1.000					\$0
1	0.935	Cap O&M	\$9,500			\$8,879
2	0.873	Cap O&M	\$9,500			\$8,298
3	0.816	Cap O&M	\$80,447			\$65,669
4	0.763	Cap O&M	\$9,500			\$7,248
5	0.713	Cap O&M	\$9,500	Five-Year Review	\$25,000	\$24,598
6	0.666	Cap O&M	\$80,447			\$53,605
7	0.623	Cap O&M	\$9,500			\$5,916
8	0.582	Cap O&M	\$9,500			\$5,529
9	0.544	Cap O&M	\$80,447			\$43,758
10	0.508	Cap O&M	\$9,500	Five-Year Review	\$25,000	\$17,538
11	0.475	Cap O&M	\$9,500			\$4,513
12	0.444	Cap O&M	\$80,447			\$35,719
13	0.415	Cap O&M	\$9,500			\$3,942
14	0.388	Cap O&M	\$9,500			\$3,684
15	0.362	Cap O&M	\$80,447	Five-Year Review	\$25,000	\$38,219
16	0.339	Cap O&M	\$9,500			\$3,218
17	0.317	Cap O&M	\$9,500			\$3,007
18	0.296	Cap O&M	\$80,447			\$23,801
19	0.277	Cap O&M	\$9,500			\$2,627
20	0.258	Cap O&M	\$9,500	Five-Year Review	\$25,000	\$8,915
21	0.242	Cap O&M	\$80,447			\$19,429
22	0.226	Cap O&M	\$9,500			\$2,144
23	0.211	Cap O&M	\$9,500			\$2,004
24	0.197	Cap O&M	\$80,447			\$15,860
25	0.184	Cap O&M	\$9,500	Five-Year Review	\$25,000	\$6,357
26	0.172	Cap O&M	\$9,500			\$1,636
27	0.161	Cap O&M	\$80,447			\$12,946
28	0.150	Cap O&M	\$9,500			\$1,429
29	0.141	Cap O&M	\$9,500			\$1,335
30	0.131	Cap O&M	\$80,447	Five-Year Review	\$25,000	\$13,852
<b>Total Present Value of Periodic Cost</b>						<b>\$445,676</b>

Notes:

1 From "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000)

2 Annual discount factor =  $1/(1+i)^t$ , where i = discount rate (includes inflation and interest) and t = year

3 Current dollar cost of future event

O&M Operations and maintenance

**Appendix A  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa**

Table A-15						
Present Value Analysis						
Year	Annual Discount Factor <sup>2</sup>	Alternative 2B - Building Demolition with Off-site Disposal (75% Hazardous)				
	30-Yr	Operation and Maintenance Costs				
		Description	Future Cost <sup>3</sup>	Description	Future Cost <sup>3</sup>	Present Value (2015)
0	1.000					\$0
1	0.935	Cap O&M	\$9,500			\$8,879
2	0.873	Cap O&M	\$9,500			\$8,298
3	0.816	Cap O&M	\$80,447			\$65,669
4	0.763	Cap O&M	\$9,500			\$7,248
5	0.713	Cap O&M	\$9,500	Five-Year Review	\$25,000	\$24,598
6	0.666	Cap O&M	\$80,447			\$53,605
7	0.623	Cap O&M	\$9,500			\$5,916
8	0.582	Cap O&M	\$9,500			\$5,529
9	0.544	Cap O&M	\$80,447			\$43,758
10	0.508	Cap O&M	\$9,500	Five-Year Review	\$25,000	\$17,538
11	0.475	Cap O&M	\$9,500			\$4,513
12	0.444	Cap O&M	\$80,447			\$35,719
13	0.415	Cap O&M	\$9,500			\$3,942
14	0.388	Cap O&M	\$9,500			\$3,684
15	0.362	Cap O&M	\$80,447	Five-Year Review	\$25,000	\$38,219
16	0.339	Cap O&M	\$9,500			\$3,218
17	0.317	Cap O&M	\$9,500			\$3,007
18	0.296	Cap O&M	\$80,447			\$23,801
19	0.277	Cap O&M	\$9,500			\$2,627
20	0.258	Cap O&M	\$9,500	Five-Year Review	\$25,000	\$8,915
21	0.242	Cap O&M	\$80,447			\$19,429
22	0.226	Cap O&M	\$9,500			\$2,144
23	0.211	Cap O&M	\$9,500			\$2,004
24	0.197	Cap O&M	\$80,447			\$15,860
25	0.184	Cap O&M	\$9,500	Five-Year Review	\$25,000	\$6,357
26	0.172	Cap O&M	\$9,500			\$1,636
27	0.161	Cap O&M	\$80,447			\$12,946
28	0.150	Cap O&M	\$9,500			\$1,429
29	0.141	Cap O&M	\$9,500			\$1,335
30	0.131	Cap O&M	\$80,447	Five-Year Review	\$25,000	\$13,852
<b>Total Present Value of Periodic Cost</b>						<b>\$445,676</b>

Notes:

1 From "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000)

2 Annual discount factor =  $1/(1+i)^t$ , where i = discount rate (includes inflation and interest) and t = year

3 Current dollar cost of future event

O&M Operations and maintenance

**Appendix A  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa**

Table A-16						
Present Value Analysis						
Year	Annual Discount Factor <sup>2</sup>	Alternative 3 - Building Demolition with On-site Containment (25-75% Hazardous)				
	30-Yr	Operation and Maintenance Costs				Present Value (2015)
		Description	Future Cost <sup>3</sup>	Description	Future Cost <sup>3</sup>	
0	1.000					\$0
1	0.935	Cap O&M	\$21,667			\$20,250
2	0.873	Cap O&M	\$21,667			\$18,925
3	0.816	Cap O&M	\$186,497			\$152,237
4	0.763	Cap O&M	\$21,667			\$16,530
5	0.713	Cap O&M	\$21,667	Five-Year Review	\$25,000	\$33,273
6	0.666	Cap O&M	\$186,497			\$124,271
7	0.623	Cap O&M	\$21,667			\$13,493
8	0.582	Cap O&M	\$21,667			\$12,610
9	0.544	Cap O&M	\$186,497			\$101,442
10	0.508	Cap O&M	\$21,667	Five-Year Review	\$25,000	\$23,723
11	0.475	Cap O&M	\$21,667			\$10,294
12	0.444	Cap O&M	\$186,497			\$82,807
13	0.415	Cap O&M	\$21,667			\$8,991
14	0.388	Cap O&M	\$21,667			\$8,403
15	0.362	Cap O&M	\$186,497	Five-Year Review	\$25,000	\$76,656
16	0.339	Cap O&M	\$21,667			\$7,339
17	0.317	Cap O&M	\$21,667			\$6,859
18	0.296	Cap O&M	\$186,497			\$55,178
19	0.277	Cap O&M	\$21,667			\$5,991
20	0.258	Cap O&M	\$21,667	Five-Year Review	\$25,000	\$12,060
21	0.242	Cap O&M	\$186,497			\$45,041
22	0.226	Cap O&M	\$21,667			\$4,891
23	0.211	Cap O&M	\$21,667			\$4,571
24	0.197	Cap O&M	\$186,497			\$36,767
25	0.184	Cap O&M	\$21,667	Five-Year Review	\$25,000	\$8,598
26	0.172	Cap O&M	\$21,667			\$3,731
27	0.161	Cap O&M	\$186,497			\$30,013
28	0.150	Cap O&M	\$21,667			\$3,259
29	0.141	Cap O&M	\$21,667			\$3,046
30	0.131	Cap O&M	\$186,497	Five-Year Review	\$25,000	\$27,784
<b>Total Present Value of Periodic Cost</b>						<b>\$959,032</b>

Notes:

1 From "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000)

2 Annual discount factor =  $1/(1+i)^t$ , where i = discount rate (includes inflation and interest) and t = year

3 Current dollar cost of future event

O&M Operations and maintenance

**APPENDIX B**  
**COST SAVINGS ANALYSIS**



**ALTERNATIVE 2**

**BUILDING DEMOLITION WITH OFF-SITE DISPOSAL**

**Appendix B**  
**Cost Savings - Vegetative Cap**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

TABLE B-1						
COST SUMMARY						
Alternative	Option	Description	Capital Cost	Institutional Controls	Operation & Maintenance	Total
2A	NA	Building Demolition with Off-site Disposal (25% Hazardous)	\$ 10,161,000	\$ 55,000	\$ 558,000	\$ 10,774,000
2B	NA	Building Demolition with Off-site Disposal (75% Hazardous)	\$ 11,778,000	\$ 55,000	\$ 558,000	\$ 12,391,000

Appendix B  
Cost Savings - Vegetative Cap  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

ALTERNATIVE 2A  
BUILDING DEMOLITION WITH OFF-SITE DISPOSAL (25% HAZARDOUS)

Table B-2				
Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)				
Source	Description	Subtotal	Contingency	Total (Rounded)
Table B-3	Design and Construction	\$ 7,815,856	\$ 2,344,756.92	\$ 10,161,000
Table B-4	Institutional Controls	\$ 42,500	\$ 12,750	\$ 55,000
Table B-5	Operation and Maintenance	\$ 428,996	\$ 128,698.88	\$ 558,000
Contingency		30%	\$ 2,486,205.80	
Total			\$	10,774,000

**Appendix B**  
**Cost Savings - Vegetative Cap**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

**Capital Cost**

Location factor (for zip code 433xx)

ECHOS	1
Get-a-Quote	1.04

Note: Location factor applied only to national average unit costs; not applied to local unit costs such as from vendors or Means.

Overhead and Profit (O&P)

General	25%	Typical general contractor overhead and profit
Means	-	NA
RACER	25%	NA
Contractor quote	5%	Prime contractor markup
Professional judgment	-	Not marked-up

Inflation 2.08% Avg. annual inflation from 2010 to 2015

Table B-3					
Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Construction Subtotal</b>				<b>\$ 6,355,232</b>
	<b>Site Preparation</b>				<b>\$ 15,000</b>
1	Temporary facilities	1.0	ls	\$ 15,000.00	\$ 15,000
	<b>Asbestos Survey</b>				<b>\$ 8,703</b>
2	Asbestos survey	1.0	ls	\$ 8,702.50	\$ 8,703
	<b>Equipment Decontamination</b>				<b>\$ 81,685</b>
3	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 69,645.00	\$ 69,645
4	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Asbestos Removal and Disposal</b>				<b>\$ 603,711</b>
5	Asbestos removal - Office Building	1.0	ls	\$ 86,733.75	\$ 86,734
6	Asbestos removal - Production Building	1.0	ls	\$ 170,078.75	\$ 170,079
7	Asbestos removal - Building 1	1.0	ls	\$ 43,548.75	\$ 43,549
8	Asbestos removal - Building 2	1.0	ls	\$ 209,323.75	\$ 209,324
9	Asbestos removal - Building 3	1.0	ls	\$ 94,025.00	\$ 94,025
	<b>PCB Removal and Disposal</b>				<b>\$ 330,886</b>
10	PCB removal - Building 2	1.0	ls	\$ 81,773.75	\$ 81,774
11	PCB removal - Building 3	1.0	ls	\$ 133,537.50	\$ 133,538
12	PCB disposal	424.0	tons	\$ 272.58	\$ 115,574
	<b>Metal Decontamination</b>				<b>\$ 96,478</b>
13	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 84,437.50	\$ 84,438
14	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Building Demolition</b>				<b>\$ 785,685</b>
15	Building demolition - Office Building	1.0	ls	\$ 76,375.84	\$ 76,376
16	Building demolition - Production Building	1.0	ls	\$ 504,541.80	\$ 504,542
17	Building demolition - Building 1	1.0	ls	\$ 14,489.11	\$ 14,489
18	Building demolition - Building 2	1.0	ls	\$ 137,498.69	\$ 137,499
19	Building demolition - Building 3	1.0	ls	\$ 51,387.91	\$ 51,388
20	Building demolition - Walkway	1.0	ls	\$ 1,390.95	\$ 1,391

**Appendix B**  
**Cost Savings - Vegetative Cap**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table B-3					
Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Slab Demolition</b>				<b>\$ 529,227</b>
21	Slab demolition - Office Building	1.0	ls	\$ 26,489.16	\$ 26,489
22	Slab demolition - Production Building	1.0	ls	\$ 241,586.65	\$ 241,587
23	Slab demolition - Building 1	1.0	ls	\$ 5,913.90	\$ 5,914
24	Slab demolition - Building 2	1.0	ls	\$ 56,116.11	\$ 56,116
25	Slab demolition - Building 3	1.0	ls	\$ 30,169.46	\$ 30,169
26	Slab demolition - Maintenance Building	1.0	ls	\$ 18,102.16	\$ 18,102
27	Slab demolition - Buildings 4 and 5	1.0	ls	\$ 150,849.76	\$ 150,850
	<b>Waste Characterization</b>				<b>\$ 88,641</b>
28	Sampling and analysis for pesticides, PCBs, and VOCs (building debris and wastewater)	1.0	ls	\$ 88,641.25	\$ 88,641
	<b>Transportation and Disposal</b>				<b>\$ 2,527,559</b>
29	Dump charges (non-hazardous waste)	29,828.0	ton	\$ 38.29	\$ 1,142,130
30	Load and haul (non-hazardous waste)	29,828.0	ton	\$ 21.46	\$ 640,194
31	Transportation and disposal (hazardous)	2,734.0	ton	\$ 272.58	\$ 745,235
	<b>Capping</b>				<b>\$ 1,122,999</b>
32	Seeding, vegetative cover	8.4	ac	\$ 4,993.43	\$ 41,745
33	Topsoil, 6 inches deep	8,429.8	lcy	\$ 51.00	\$ 429,920
34	Fill, 6 inches deep	8,429.8	cy	\$ 34.89	\$ 294,095
35	Clay, low permeability, 6 inches deep	9,441.4	cy	\$ 37.84	\$ 357,239
	<b>Crushing</b>				<b>\$ 103,212</b>
36	Bulldozer (crushing non-hazardous debris for fill)	160.0	hour	\$ 267.40	\$ 42,784
37	Backhoe, 0.75 CY (crushing non-hazardous debris for fill)	160.0	hour	\$ 142.55	\$ 22,808
38	Jackhammer (crushing of non-hazardous debris for fill)	160.0	hour	\$ 235.13	\$ 37,620
	<b>Measurement</b>				<b>\$ 61,446</b>
39	Pre-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
40	Post-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
Construction subtotal				\$	6,355,232
Construction Contractor Mobe/Demobe, Site Prep and Submittals				10%	\$ 635,523.20
Pre-design investigation				10%	\$ 635,523.20
Engineering design				18%	\$ 1,143,941.76
Project management and construction oversight				7%	\$ 444,866.24
Recycling of metal (15,547 tons at \$90 per ton)					\$ (1,399,230.00)
<b>Capital Cost Subtotal</b>				<b>\$</b>	<b>7,815,856</b>

Appendix B  
Cost Savings - Vegetative Cap  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

Table B-4					
Institutional Controls					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Institutional Controls Subtotal</b>				<b>\$ 42,500</b>
41	Prepare LUC Implementation Plan (mid-level staff with senior review)	250	hr	\$ 110.00	\$ 27,500
42	Meetings with agencies (senior staff and attorneys)	60	hr	\$ 250.00	\$ 15,000

Operation and Maintenance

Table B-5					
Operation and Maintenance					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Annual Operation and Maintenance Subtotal</b>				<b>\$ 30,224</b>
	<b>Cap Monitoring</b>				<b>\$ 9,500</b>
43	Engineer site visit (1 per year)	1.0	ls	\$ 3,500.00	\$ 3,500
44	Proj. Mgmt. 2 hrs/wk on proj for 24 weeks	48.0	hr	\$ 125.00	\$ 6,000
	<b>Cap Repair (every 3 years)</b>				<b>\$ -</b>
45	Seal coat	0.0	sf	\$ 0.17	\$ -
46	Crack sealing	0.0	lf	\$ 0.86	\$ -

Appendix B  
Cost Savings - Vegetative Cap  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

ALTERNATIVE 2B  
BUILDING DEMOLITION WITH OFF-SITE DISPOSAL (75% HAZARDOUS)

Table B-6				
Alternative 2A - Building Demolition with Off-site Disposal (75% Hazardous)				
Source	Description	Subtotal	Contingency	Total (Rounded)
Table B-7	Design and Construction	\$ 9,060,129	\$ 2,718,038.69	\$ 11,778,000
Table B-8	Institutional Controls	\$ 42,500	\$ 12,750	\$ 55,000
Table B-9	Operation and Maintenance	\$ 428,996	\$ 128,698.88	\$ 558,000
Contingency		30%	\$ 2,859,487.57	
Total			\$ 12,391,000	

Appendix B  
Cost Savings - Vegetative Cap  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

Capital Cost

Location factor (for zip code 433xx)

ECHOS	1
Get-a-Quote	1.04

Note: Location factor applied only to national average unit costs; not applied to local unit costs such as from vendors or Means.

Overhead and Profit (O&P)

General	25%	Typical general contractor overhead and profit
Means	-	NA
RACER	25%	NA
Contractor quote	5%	Prime contractor markup
Professional judgment	-	Not marked-up

Inflation 2.08% Avg. annual inflation from 2010 to 2015

Table B-7					
Alternative 2A - Building Demolition with Off-site Disposal (75% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Construction Subtotal</b>				<b>\$ 7,213,351</b>
	<b>Site Preparation</b>				<b>\$ 15,000</b>
1	Temporary facilities	1.0	ls	\$ 15,000.00	\$ 15,000
	<b>Asbestos Survey</b>				<b>\$ 8,703</b>
2	Asbestos survey	1.0	ls	\$ 8,702.50	\$ 8,703
	<b>Equipment Decontamination</b>				<b>\$ 81,685</b>
3	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 69,645.00	\$ 69,645
4	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Asbestos Removal and Disposal</b>				<b>\$ 603,711</b>
5	Asbestos removal - Office Building	1.0	ls	\$ 86,733.75	\$ 86,734
6	Asbestos removal - Production Building	1.0	ls	\$ 170,078.75	\$ 170,079
7	Asbestos removal - Building 1	1.0	ls	\$ 43,548.75	\$ 43,549
8	Asbestos removal - Building 2	1.0	ls	\$ 209,323.75	\$ 209,324
9	Asbestos removal - Building 3	1.0	ls	\$ 94,025.00	\$ 94,025
	<b>PCB Removal and Disposal</b>				<b>\$ 330,886</b>
10	PCB removal - Building 2	1.0	ls	\$ 81,773.75	\$ 81,774
11	PCB removal - Building 3	1.0	ls	\$ 133,537.50	\$ 133,538
12	PCB disposal	424.0	tons	\$ 272.58	\$ 115,574
	<b>Metal Decontamination</b>				<b>\$ 96,478</b>
13	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 84,437.50	\$ 84,438
14	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Building Demolition</b>				<b>\$ 785,685</b>
15	Building demolition - Office Building	1.0	ls	\$ 76,375.84	\$ 76,376
16	Building demolition - Production Building	1.0	ls	\$ 504,541.80	\$ 504,542
17	Building demolition - Building 1	1.0	ls	\$ 14,489.11	\$ 14,489
18	Building demolition - Building 2	1.0	ls	\$ 137,498.69	\$ 137,499
19	Building demolition - Building 3	1.0	ls	\$ 51,387.91	\$ 51,388
20	Building demolition - Walkway	1.0	ls	\$ 1,390.95	\$ 1,391



**Appendix B**  
**Cost Savings - Vegetative Cap**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table B-7					
Alternative 2A - Building Demolition with Off-site Disposal (75% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Slab Demolition</b>				<b>\$ 529,227</b>
21	Slab demolition - Office Building	1.0	ls	\$ 26,489.16	\$ 26,489
22	Slab demolition - Production Building	1.0	ls	\$ 241,586.65	\$ 241,587
23	Slab demolition - Building 1	1.0	ls	\$ 5,913.90	\$ 5,914
24	Slab demolition - Building 2	1.0	ls	\$ 56,116.11	\$ 56,116
25	Slab demolition - Building 3	1.0	ls	\$ 30,169.46	\$ 30,169
26	Slab demolition - Maintenance Building	1.0	ls	\$ 18,102.16	\$ 18,102
27	Slab demolition - Buildings 4 and 5	1.0	ls	\$ 150,849.76	\$ 150,850
	<b>Waste Characterization</b>				<b>\$ 88,641</b>
28	Sampling and analysis for pesticides, PCBs, and VOCs (building debris and wastewater)	1.0	ls	\$ 88,641.25	\$ 88,641
	<b>Transportation and Disposal</b>				<b>\$ 3,385,678</b>
29	Dump charges (non-hazardous waste)	25,796.0	ton	\$ 38.29	\$ 987,743
30	Load and haul (non-hazardous waste)	25,796.0	ton	\$ 21.46	\$ 553,656
31	Transportation and disposal (hazardous)	6,766.0	ton	\$ 272.58	\$ 1,844,279
	<b>Capping</b>				<b>\$ 1,122,999</b>
32	Seeding, vegetative cover	8.4	ac	\$ 4,993.43	\$ 41,745
33	Topsoil, 6 inches deep	8,429.8	lcy	\$ 51.00	\$ 429,920
34	Fill, 6 inches deep	8,429.8	cy	\$ 34.89	\$ 294,095
35	Clay, low permeability, 6 inches deep	9,441.4	cy	\$ 37.84	\$ 357,239
	<b>Crushing</b>				<b>\$ 103,212</b>
36	Bulldozer (crushing non-hazardous debris for fill)	160.0	hour	\$ 267.40	\$ 42,784
37	Backhoe, 0.75 CY (crushing non-hazardous debris for fill)	160.0	hour	\$ 142.55	\$ 22,808
38	Jackhammer (crushing of non-hazardous debris for fill)	160.0	hour	\$ 235.13	\$ 37,620
	<b>Measurement</b>				<b>\$ 61,446</b>
39	Pre-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
40	Post-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
Construction subtotal					\$ 7,213,351
Construction Contractor Mobe/Demobe, Site Prep and Submittals					\$ 721,335.10
Pre-design investigation					\$ 721,335.10
Engineering design					\$ 1,298,403.18
Project management and construction oversight					\$ 504,934.57
Recycling of metal (15,547 tons at \$90 per ton)					\$ (1,399,230.00)
<b>Capital Cost Subtotal</b>					<b>\$ 9,060,129</b>

Appendix B  
Cost Savings - Vegetative Cap  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

Table B-8					
Institutional Controls					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	Institutional Controls Subtotal				\$ 42,500
41	Prepare LUC Implementation Plan (mid-level staff with senior review)	250	hr	\$ 110.00	\$ 27,500
42	Meetings with agencies (senior staff and attorneys)	60	hr	\$ 250.00	\$ 15,000

Operation and Maintenance

Table B-9					
Operation and Maintenance					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	Annual Operation and Maintenance Subtotal				\$ 30,224
	Cap Monitoring				\$ 9,500
43	Engineer site visit (1 per year)	1.0	ls	\$ 3,500.00	\$ 3,500
44	Proj. Mgmt. 2 hrs/wk on proj for 24 weeks	48.0	hr	\$ 125.00	\$ 6,000
	Cap Repair (every 3 years)				\$ -
45	Seal coat	0.0	sf	\$ 0.17	\$ -
46	Crack sealing	0.0	lf	\$ 0.86	\$ -
	Prescriptive Cap Repair				\$ 20,724
47	Re-seeding (25 percent of cap)	2.1	acre	\$ 4,993.48	\$ 10,486
48	Fertilization	8.4	acre	\$ 921.16	\$ 7,738
49	Erosion repair	1.0	ls	\$ 2,500.00	\$ 2,500

**Appendix B**  
**Cost Savings - Vegetative Cap**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Annual Discount Rate <sup>1</sup>:

30-Yr 7.00%

Table B-10						
Present Value Analysis						
Year	Annual Discount Factor <sup>2</sup>	Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)				
		1E-5 Risk				
		Operation and Maintenance Costs				
	30-Yr	Description	Future Cost <sup>3</sup>	Description	Future Cost <sup>3</sup>	Present Value (2015)
0	1.000					\$0
1	0.935	Cap O&M	\$30,224			\$28,247
2	0.873	Cap O&M	\$30,224			\$26,399
3	0.816	Cap O&M	\$30,224			\$24,672
4	0.763	Cap O&M	\$30,224			\$23,058
5	0.713	Cap O&M	\$30,224	Five-Year Review	\$25,000	\$39,374
6	0.666	Cap O&M	\$30,224			\$20,140
7	0.623	Cap O&M	\$30,224			\$18,822
8	0.582	Cap O&M	\$30,224			\$17,591
9	0.544	Cap O&M	\$30,224			\$16,440
10	0.508	Cap O&M	\$30,224	Five-Year Review	\$25,000	\$28,073
11	0.475	Cap O&M	\$30,224			\$14,359
12	0.444	Cap O&M	\$30,224			\$13,420
13	0.415	Cap O&M	\$30,224			\$12,542
14	0.388	Cap O&M	\$30,224			\$11,721
15	0.362	Cap O&M	\$30,224	Five-Year Review	\$25,000	\$20,016
16	0.339	Cap O&M	\$30,224			\$10,238
17	0.317	Cap O&M	\$30,224			\$9,568
18	0.296	Cap O&M	\$30,224			\$8,942
19	0.277	Cap O&M	\$30,224			\$8,357
20	0.258	Cap O&M	\$30,224	Five-Year Review	\$25,000	\$14,271
21	0.242	Cap O&M	\$30,224			\$7,299
22	0.226	Cap O&M	\$30,224			\$6,822
23	0.211	Cap O&M	\$30,224			\$6,376
24	0.197	Cap O&M	\$30,224			\$5,959
25	0.184	Cap O&M	\$30,224	Five-Year Review	\$25,000	\$10,175
26	0.172	Cap O&M	\$30,224			\$5,204
27	0.161	Cap O&M	\$30,224			\$4,864
28	0.150	Cap O&M	\$30,224			\$4,546
29	0.141	Cap O&M	\$30,224			\$4,248
30	0.131	Cap O&M	\$30,224	Five-Year Review	\$25,000	\$7,255
<b>Total Present Value of Periodic Cost</b>						<b>\$428,996</b>

Notes:

- 1 From OMB Circular A-94 Appendix C, Updated November 2015
- 2 Annual discount factor =  $1/(1+i)^t$ , where i = discount rate (includes inflation and interest) and t = year
- 3 Current dollar cost of future event
- O&M Operations and maintenance

**Appendix B**  
**Cost Savings - Vegetative Cap**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table B-11						
Present Value Analysis						
Year	Annual Discount Factor <sup>2</sup>	Alternative 2B - Building Demolition with Off-site Disposal (75% Hazardous)				
		Operation and Maintenance Costs				
	30-Yr	Description	Future Cost <sup>3</sup>	Description	Future Cost <sup>3</sup>	Present Value (2015)
0	1.000					\$0
1	0.935	Cap O&M	\$30,224			\$28,247
2	0.873	Cap O&M	\$30,224			\$26,399
3	0.816	Cap O&M	\$30,224			\$24,672
4	0.763	Cap O&M	\$30,224			\$23,058
5	0.713	Cap O&M	\$30,224	Five-Year Review	\$25,000	\$39,374
6	0.666	Cap O&M	\$30,224			\$20,140
7	0.623	Cap O&M	\$30,224			\$18,822
8	0.582	Cap O&M	\$30,224			\$17,591
9	0.544	Cap O&M	\$30,224			\$16,440
10	0.508	Cap O&M	\$30,224	Five-Year Review	\$25,000	\$28,073
11	0.475	Cap O&M	\$30,224			\$14,359
12	0.444	Cap O&M	\$30,224			\$13,420
13	0.415	Cap O&M	\$30,224			\$12,542
14	0.388	Cap O&M	\$30,224			\$11,721
15	0.362	Cap O&M	\$30,224	Five-Year Review	\$25,000	\$20,016
16	0.339	Cap O&M	\$30,224			\$10,238
17	0.317	Cap O&M	\$30,224			\$9,568
18	0.296	Cap O&M	\$30,224			\$8,942
19	0.277	Cap O&M	\$30,224			\$8,357
20	0.258	Cap O&M	\$30,224	Five-Year Review	\$25,000	\$14,271
21	0.242	Cap O&M	\$30,224			\$7,299
22	0.226	Cap O&M	\$30,224			\$6,822
23	0.211	Cap O&M	\$30,224			\$6,376
24	0.197	Cap O&M	\$30,224			\$5,959
25	0.184	Cap O&M	\$30,224	Five-Year Review	\$25,000	\$10,175
26	0.172	Cap O&M	\$30,224			\$5,204
27	0.161	Cap O&M	\$30,224			\$4,864
28	0.150	Cap O&M	\$30,224			\$4,546
29	0.141	Cap O&M	\$30,224			\$4,248
30	0.131	Cap O&M	\$30,224	Five-Year Review	\$25,000	\$7,255
<b>Total Present Value of Periodic Cost</b>						<b>\$428,996</b>

Notes:

1 From "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000)

2 Annual discount factor =  $1/(1+i)^t$ , where i = discount rate (includes inflation and interest) and t = year

3 Current dollar cost of future event

O&M Operations and maintenance

**Appendix B**  
**Cost Savings - No Cap**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

TABLE B-1						
COST SUMMARY						
Alternative	Option	Description	Capital Cost	Institutional Controls	Operation & Maintenance	Total
2A	NA	Building Demolition with Off-site Disposal (25% Hazardous)	\$ 8,363,000	\$ 55,000	\$ 167,000	\$ 8,585,000
2B	NA	Building Demolition with Off-site Disposal (75% Hazardous)	\$ 9,980,000	\$ 55,000	\$ 167,000	\$ 10,202,000

Appendix B  
Cost Savings - No Cap  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

ALTERNATIVE 2A  
BUILDING DEMOLITION WITH OFF-SITE DISPOSAL (25% HAZARDOUS)

Table B-2				
Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)				
Source	Description	Subtotal	Contingency	Total (Rounded)
Table B-3	Design and Construction	\$ 6,432,707	\$ 1,929,812	\$ 8,363,000
Table B-4	Institutional Controls	\$ 42,500	\$ 12,750	\$ 55,000
Table B-5	Operation and Maintenance	\$ 128,400	\$ 38,520	\$ 167,000
Contingency		30%	\$ 1,981,082	
Total			\$	8,585,000

**Appendix B**  
**Cost Savings - No Cap**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

**Capital Cost**

Location factor (for zip code 433xx)

ECHOS	1
Get-a-Quote	1.04

Note: Location factor applied only to national average unit costs; not applied to local unit costs such as from vendors or Means.

Overhead and Profit (O&P)

General	25%	Typical general contractor overhead and profit
Means	-	NA
RACER	25%	NA
Contractor quote	5%	Prime contractor markup
Professional judgment	-	Not marked-up

Inflation 2.08% Avg. annual inflation from 2010 to 2015

Table B-3					
Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Construction Subtotal</b>				<b>\$ 5,401,336</b>
	<b>Site Preparation</b>				<b>\$ 15,000</b>
1	Temporary facilities	1.0	ls	\$ 15,000.00	\$ 15,000
	<b>Asbestos Survey</b>				<b>\$ 8,703</b>
2	Asbestos survey	1.0	ls	\$ 8,702.50	\$ 8,703
	<b>Equipment Decontamination</b>				<b>\$ 81,685</b>
3	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 69,645.00	\$ 69,645
4	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Asbestos Removal and Disposal</b>				<b>\$ 603,711</b>
5	Asbestos removal - Office Building	1.0	ls	\$ 86,733.75	\$ 86,734
6	Asbestos removal - Production Building	1.0	ls	\$ 170,078.75	\$ 170,079
7	Asbestos removal - Building 1	1.0	ls	\$ 43,548.75	\$ 43,549
8	Asbestos removal - Building 2	1.0	ls	\$ 209,323.75	\$ 209,324
9	Asbestos removal - Building 3	1.0	ls	\$ 94,025.00	\$ 94,025
	<b>PCB Removal and Disposal</b>				<b>\$ 330,886</b>
10	PCB removal - Building 2	1.0	ls	\$ 81,773.75	\$ 81,774
11	PCB removal - Building 3	1.0	ls	\$ 133,537.50	\$ 133,538
12	PCB disposal	424.0	ton	\$ 272.58	\$ 115,574
	<b>Metal Decontamination</b>				<b>\$ 96,478</b>
13	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 84,437.50	\$ 84,438
14	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Building Demolition</b>				<b>\$ 785,685</b>
15	Building demolition - Office Building	1.0	ls	\$ 76,375.84	\$ 76,376
16	Building demolition - Production Building	1.0	ls	\$ 504,541.80	\$ 504,542
17	Building demolition - Building 1	1.0	ls	\$ 14,489.11	\$ 14,489
18	Building demolition - Building 2	1.0	ls	\$ 137,498.69	\$ 137,499
19	Building demolition - Building 3	1.0	ls	\$ 51,387.91	\$ 51,388
20	Building demolition - Walkway	1.0	ls	\$ 1,390.95	\$ 1,391

**Appendix B**  
**Cost Savings - No Cap**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table B-3					
Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Slab Demolition</b>				<b>\$ 529,227</b>
21	Slab demolition - Office Building	1.0	ls	\$ 26,489.16	\$ 26,489
22	Slab demolition - Production Building	1.0	ls	\$ 241,586.65	\$ 241,587
23	Slab demolition - Building 1	1.0	ls	\$ 5,913.90	\$ 5,914
24	Slab demolition - Building 2	1.0	ls	\$ 56,116.11	\$ 56,116
25	Slab demolition - Building 3	1.0	ls	\$ 30,169.46	\$ 30,169
26	Slab demolition - Maintenance Building	1.0	ls	\$ 18,102.16	\$ 18,102
27	Slab demolition - Buildings 4 and 5	1.0	ls	\$ 150,849.76	\$ 150,850
	<b>Waste Characterization</b>				<b>\$ 88,641</b>
28	Sampling and analysis for pesticides, PCBs, and VOCs (building debris and wastewater)	1.0	ls	\$ 88,641.25	\$ 88,641
	<b>Transportation and Disposal</b>				<b>\$ 2,696,662</b>
29	Dump charges (non-hazardous waste)	32,658.0	ton	\$ 38.29	\$ 1,250,493
30	Load and haul (non-hazardous waste)	32,658.0	ton	\$ 21.46	\$ 700,934
31	Transportation and disposal (hazardous)	2,734.0	ton	\$ 272.58	\$ 745,235
	<b>Capping</b>				<b>\$ -</b>
32	Asphalt pavement - 6 inch base course layer, 3 inch topping	0.0	sy	\$ 46.60	\$ -
33	Cap material sampling and analysis (every 500 ft)	0.0	ea	\$ 2,000.00	\$ -
34	Cap thickness verification (every 100 ft)	0.0	ea	\$ 150.00	\$ -
	<b>Crushing</b>				<b>\$ 103,212</b>
35	Bulldozer (crushing non-hazardous debris for fill)	160.0	hr	\$ 267.40	\$ 42,784
36	Backhoe, 0.75 CY (crushing non-hazardous debris for fill)	160.0	hr	\$ 142.55	\$ 22,808
37	Jackhammer (crushing of non-hazardous debris for fill)	160.0	hr	\$ 235.13	\$ 37,620
	<b>Measurement</b>				<b>\$ 61,446</b>
38	Pre-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
39	Post-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
Construction subtotal				\$	5,401,336
Construction Contractor Mobe/Demobe, Site Prep and Submittals				10%	\$ 540,134
Pre-design investigation				10%	\$ 540,134
Engineering design				18%	\$ 972,240
Project management and construction oversight				7%	\$ 378,094
Recycling of metal (15,547 tons at \$90 per ton)					\$ (1,399,230)
<b>Capital Cost Subtotal</b>				<b>\$</b>	<b>6,432,707</b>



Appendix B  
Cost Savings - No Cap  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

Table B-4					
Institutional Controls					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Institutional Controls Subtotal</b>				<b>\$ 42,500</b>
40	Prepare LUC Implementation Plan (mid-level staff with senior review)	250	hr	\$ 110.00	\$ 27,500
41	Meetings with agencies (senior staff and attorneys)	60	hr	\$ 250.00	\$ 15,000

Operation and Maintenance

Table B-5					
Operation and Maintenance					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Annual Operation and Maintenance Subtotal</b>				<b>\$ 11,000</b>
	<b>Cap Monitoring</b>				<b>\$ 6,000</b>
42	Engineer site visit (1 per year)	0.0	ls	\$ 3,500.00	\$ -
43	Proj. Mgmt. 2 hrs/wk on proj for 24 weeks	48.0	hr	\$ 125.00	\$ 6,000
	<b>Cap Repair (every 3 years)</b>				<b>\$ -</b>
44	Seal coat	0.0	sf	\$ 0.17	\$ -
45	Crack sealing	0.0	lf	\$ 0.86	\$ -
	<b>Five-Year Review (every 5 years)</b>				<b>\$ 25,000</b>
46	Five-year review	1.0	ls	\$ 25,000.00	\$ 25,000

Notes:  
ea Each  
hr Hour  
lf Linear foot  
ls Lump sum  
sf Square foot  
sy Square yard

Appendix B  
Cost Savings - No Cap  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

ALTERNATIVE 2B  
BUILDING DEMOLITION WITH OFF-SITE DISPOSAL (75% HAZARDOUS)

Table B-6				
Alternative 2B - Building Demolition with Off-site Disposal (75% Hazardous)				
Source	Description	Subtotal	Contingency	Total (Rounded)
Table B-7	Design and Construction	\$ 7,676,978	\$ 2,303,093	\$ 9,980,000
Table B-8	Institutional Controls	\$ 42,500	\$ 12,750	\$ 55,000
Table B-9	Operation and Maintenance	\$ 128,400	\$ 38,520	\$ 167,000
Contingency		30%	\$ 2,354,363	
Total			\$	10,202,000

Appendix B  
Cost Savings - No Cap  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

Capital Cost

Location factor (for zip code 433xx)

ECHOS	1
Get-a-Quote	1.04

Note: Location factor applied only to national average unit costs; not applied to local unit costs such as from vendors or Means.

Overhead and Profit (O&P)

General	25%	Typical general contractor overhead and profit
Means	-	NA
RACER	25%	NA
Contractor quote	5%	Prime contractor markup
Professional judgment	-	Not marked-up

Inflation 2.08% Avg. annual inflation from 2010 to 2015

Table B-7					
Alternative 2B - Building Demolition with Off-site Disposal (75% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Construction Subtotal</b>				<b>\$ 6,259,454</b>
	<b>Site Preparation</b>				<b>\$ 15,000</b>
1	Temporary facilities	1.0	ls	\$ 15,000.00	\$ 15,000
	<b>Asbestos Survey</b>				<b>\$ 8,703</b>
2	Asbestos survey	1.0	ls	\$ 8,702.50	\$ 8,703
	<b>Equipment Decontamination</b>				<b>\$ 81,685</b>
3	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 69,645.00	\$ 69,645
4	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Asbestos Removal and Disposal</b>				<b>\$ 603,711</b>
5	Asbestos removal - Office Building	1.0	ls	\$ 86,733.75	\$ 86,734
6	Asbestos removal - Production Building	1.0	ls	\$ 170,078.75	\$ 170,079
7	Asbestos removal - Building 1	1.0	ls	\$ 43,548.75	\$ 43,549
8	Asbestos removal - Building 2	1.0	ls	\$ 209,323.75	\$ 209,324
9	Asbestos removal - Building 3	1.0	ls	\$ 94,025.00	\$ 94,025
	<b>PCB Removal and Disposal</b>				<b>\$ 330,886</b>
10	PCB removal - Building 2	1.0	ls	\$ 81,773.75	\$ 81,774
11	PCB removal - Building 3	1.0	ls	\$ 133,537.50	\$ 133,538
12	PCB disposal	424.0	ton	\$ 272.58	\$ 115,574
	<b>Metal Decontamination</b>				<b>\$ 96,478</b>
13	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 84,437.50	\$ 84,438
14	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Building Demolition</b>				<b>\$ 785,685</b>
15	Building demolition - Office Building	1.0	ls	\$ 76,375.84	\$ 76,376
16	Building demolition - Production Building	1.0	ls	\$ 504,541.80	\$ 504,542
17	Building demolition - Building 1	1.0	ls	\$ 14,489.11	\$ 14,489
18	Building demolition - Building 2	1.0	ls	\$ 137,498.69	\$ 137,499
19	Building demolition - Building 3	1.0	ls	\$ 51,387.91	\$ 51,388
20	Building demolition - Walkway	1.0	ls	\$ 1,390.95	\$ 1,391

**Appendix B**  
**Cost Savings - No Cap**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table B-7					
Alternative 2B - Building Demolition with Off-site Disposal (75% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Slab Demolition</b>				<b>\$ 529,227</b>
21	Slab demolition - Office Building	1.0	ls	\$ 26,489.16	\$ 26,489
22	Slab demolition - Production Building	1.0	ls	\$ 241,586.65	\$ 241,587
23	Slab demolition - Building 1	1.0	ls	\$ 5,913.90	\$ 5,914
24	Slab demolition - Building 2	1.0	ls	\$ 56,116.11	\$ 56,116
25	Slab demolition - Building 3	1.0	ls	\$ 30,169.46	\$ 30,169
26	Slab demolition - Maintenance Building	1.0	ls	\$ 18,102.16	\$ 18,102
27	Slab demolition - Buildings 4 and 5	1.0	ls	\$ 150,849.76	\$ 150,850
	<b>Waste Characterization</b>				<b>\$ 88,641</b>
28	Sampling and analysis for pesticides, PCBs, and VOCs (building debris and wastewater)	1.0	ls	\$ 88,641.25	\$ 88,641
	<b>Transportation and Disposal</b>				<b>\$ 3,554,780</b>
29	Dump charges (non-hazardous waste)	28,626.0	ton	\$ 38.29	\$ 1,096,105
30	Load and haul (non-hazardous waste)	28,626.0	ton	\$ 21.46	\$ 614,396
31	Transportation and disposal (hazardous)	6,766.0	ton	\$ 272.58	\$ 1,844,279
	<b>Capping</b>				<b>\$ -</b>
32	Asphalt pavement - 6 inch base course layer, 3 inch topping	0.0	sy	\$ 46.60	\$ -
33	Cap material sampling and analysis (every 500 ft)	0.0	ea	\$ 2,000.00	\$ -
34	Cap thickness verification (every 100 ft)	0.0	ea	\$ 150.00	\$ -
	<b>Crushing</b>				<b>\$ 103,212</b>
35	Bulldozer (crushing non-hazardous debris for fill)	160.0	hr	\$ 267.40	\$ 42,784
36	Backhoe, 0.75 CY (crushing non-hazardous debris for fill)	160.0	hr	\$ 142.55	\$ 22,808
37	Jackhammer (crushing of non-hazardous debris for fill)	160.0	hr	\$ 235.13	\$ 37,620
	<b>Measurement</b>				<b>\$ 61,446</b>
38	Pre-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
39	Post-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
Construction subtotal					\$ 6,259,454
Construction Contractor Mobe/Demobe, Site Prep and Submittals					\$ 625,945.40
Pre-design investigation					\$ 625,945.40
Engineering design					\$ 1,126,701.72
Project management and construction oversight					\$ 438,161.78
Recycling of metal (15,547 tons at \$90 per ton)					\$ (1,399,230.00)
<b>Capital Cost Subtotal</b>					<b>\$ 7,676,978</b>

Appendix B  
Cost Savings - No Cap  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

Table B-8					
Institutional Controls					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	Institutional Controls Subtotal				\$ 42,500
40	Prepare LUC Implementation Plan (mid-level staff with senior review)	250	hr	\$ 110.00	\$ 27,500
41	Meetings with agencies (senior staff and attorneys)	60	hr	\$ 250.00	\$ 15,000

Operation and Maintenance

Table B-9					
Operation and Maintenance					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	Annual Operation and Maintenance Subtotal				\$ 11,000
	Cap Monitoring				\$ 6,000
42	Engineer site visit (1 per year)	0.0	ls	\$ 3,500.00	\$ -
43	Proj. Mgmt. 2 hrs/wk on proj for 24 weeks	48.0	hr	\$ 125.00	\$ 6,000
	Cap Repair (every 3 years)				\$ -
44	Seal coat	0.0	sf	\$ 0.17	\$ -
45	Crack sealing	0.0	lf	\$ 0.86	\$ -
	Five-Year Review (every 5 years)				\$ 25,000
46	Five-year review	1.0	ls	\$ 25,000.00	\$ 25,000

Notes:

ea	Each
hr	Hour
lf	Linear foot
ls	Lump sum
sf	Square foot
sy	Square yard

**Appendix B**  
**Cost Savings - No Cap**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Annual Discount Rate <sup>1</sup>:

30-Yr 7.00%

Table B-10						
Present Value Analysis						
Year	Annual Discount Factor <sup>2</sup>	Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)				
	30-Yr	Operation and Maintenance Costs				
		Description	Future Cost <sup>3</sup>	Description	Future Cost <sup>3</sup>	Present Value (2015)
0	1.000					\$0
1	0.935	Cap O&M	\$6,000			\$5,607
2	0.873	Cap O&M	\$6,000			\$5,241
3	0.816	Cap O&M	\$6,000			\$4,898
4	0.763	Cap O&M	\$6,000			\$4,577
5	0.713	Cap O&M	\$6,000	Five-Year Review	\$25,000	\$22,103
6	0.666	Cap O&M	\$6,000			\$3,998
7	0.623	Cap O&M	\$6,000			\$3,736
8	0.582	Cap O&M	\$6,000			\$3,492
9	0.544	Cap O&M	\$6,000			\$3,264
10	0.508	Cap O&M	\$6,000	Five-Year Review	\$25,000	\$15,759
11	0.475	Cap O&M	\$6,000			\$2,851
12	0.444	Cap O&M	\$6,000			\$2,664
13	0.415	Cap O&M	\$6,000			\$2,490
14	0.388	Cap O&M	\$6,000			\$2,327
15	0.362	Cap O&M	\$6,000	Five-Year Review	\$25,000	\$11,236
16	0.339	Cap O&M	\$6,000			\$2,032
17	0.317	Cap O&M	\$6,000			\$1,899
18	0.296	Cap O&M	\$6,000			\$1,775
19	0.277	Cap O&M	\$6,000			\$1,659
20	0.258	Cap O&M	\$6,000	Five-Year Review	\$25,000	\$8,011
21	0.242	Cap O&M	\$6,000			\$1,449
22	0.226	Cap O&M	\$6,000			\$1,354
23	0.211	Cap O&M	\$6,000			\$1,266
24	0.197	Cap O&M	\$6,000			\$1,183
25	0.184	Cap O&M	\$6,000	Five-Year Review	\$25,000	\$5,712
26	0.172	Cap O&M	\$6,000			\$1,033
27	0.161	Cap O&M	\$6,000			\$966
28	0.150	Cap O&M	\$6,000			\$902
29	0.141	Cap O&M	\$6,000			\$843
30	0.131	Cap O&M	\$6,000	Five-Year Review	\$25,000	\$4,072
<b>Total Present Value of Periodic Cost</b>						<b>\$128,400</b>

Notes:

1 From "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000)

2 Annual discount factor =  $1/(1+i)^t$ , where i = discount rate (includes inflation and interest) and t = year

3 Current dollar cost of future event

O&M Operations and maintenance

**Appendix B**  
**Cost Savings - No Cap**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table B-11						
Present Value Analysis						
Year	Annual Discount Factor <sup>2</sup>	Alternative 2B - Building Demolition with Off-site Disposal (75% Hazardous)				
		Operation and Maintenance Costs				
	30-Yr	Description	Future Cost <sup>3</sup>	Description	Future Cost <sup>3</sup>	Present Value (2015)
0	1.000					\$0
1	0.935	Cap O&M	\$6,000			\$5,607
2	0.873	Cap O&M	\$6,000			\$5,241
3	0.816	Cap O&M	\$6,000			\$4,898
4	0.763	Cap O&M	\$6,000			\$4,577
5	0.713	Cap O&M	\$6,000	Five-Year Review	\$25,000	\$22,103
6	0.666	Cap O&M	\$6,000			\$3,998
7	0.623	Cap O&M	\$6,000			\$3,736
8	0.582	Cap O&M	\$6,000			\$3,492
9	0.544	Cap O&M	\$6,000			\$3,264
10	0.508	Cap O&M	\$6,000	Five-Year Review	\$25,000	\$15,759
11	0.475	Cap O&M	\$6,000			\$2,851
12	0.444	Cap O&M	\$6,000			\$2,664
13	0.415	Cap O&M	\$6,000			\$2,490
14	0.388	Cap O&M	\$6,000			\$2,327
15	0.362	Cap O&M	\$6,000	Five-Year Review	\$25,000	\$11,236
16	0.339	Cap O&M	\$6,000			\$2,032
17	0.317	Cap O&M	\$6,000			\$1,899
18	0.296	Cap O&M	\$6,000			\$1,775
19	0.277	Cap O&M	\$6,000			\$1,659
20	0.258	Cap O&M	\$6,000	Five-Year Review	\$25,000	\$8,011
21	0.242	Cap O&M	\$6,000			\$1,449
22	0.226	Cap O&M	\$6,000			\$1,354
23	0.211	Cap O&M	\$6,000			\$1,266
24	0.197	Cap O&M	\$6,000			\$1,183
25	0.184	Cap O&M	\$6,000	Five-Year Review	\$25,000	\$5,712
26	0.172	Cap O&M	\$6,000			\$1,033
27	0.161	Cap O&M	\$6,000			\$966
28	0.150	Cap O&M	\$6,000			\$902
29	0.141	Cap O&M	\$6,000			\$843
30	0.131	Cap O&M	\$6,000	Five-Year Review	\$25,000	\$4,072
<b>Total Present Value of Periodic Cost</b>						<b>\$128,400</b>

Notes:

1 From "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000)

2 Annual discount factor =  $1/(1+i)^t$ , where i = discount rate (includes inflation and interest) and t = year

3 Current dollar cost of future event

O&M Operations and maintenance

**Appendix B**  
**Cost Savings - Non-hazardous Debris Disposal in SPA**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

TABLE B-1						
COST SUMMARY						
Alternative	Option	Description	Capital Cost	Institutional Controls	Operation & Maintenance	Total
2A	NA	Building Demolition with Off-site Disposal (25% Hazardous)	\$ 10,660,000	\$ 55,000	\$ 579,000	\$ 11,294,000
2B	NA	Building Demolition with Off-site Disposal (75% Hazardous)	\$ 12,339,000	\$ 55,000	\$ 579,000	\$ 12,973,000



Appendix B  
Cost Savings - Non-hazardous Debris Disposal in SPA  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

ALTERNATIVE 2A  
BUILDING DEMOLITION WITH OFF-SITE DISPOSAL (25% HAZARDOUS)

Table B-2				
Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)				
Source	Description	Subtotal	Contingency	Total (Rounded)
Table B-3	Design and Construction	\$ 8,199,953	\$ 2,459,986	\$ 10,660,000
Table B-4	Institutional Controls	\$ 42,500	\$ 12,750	\$ 55,000
Table B-5	Operation and Maintenance	\$ 445,676	\$ 133,703	\$ 579,000
Contingency		30%	\$ 2,606,439	
Total			\$	11,294,000

**Appendix B**  
**Cost Savings - Non-hazardous Debris Disposal in SPA**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

**Capital Cost**

Location factor (for zip code 433xx)

ECHOS	1
Get-a-Quote	1.04

Note: Location factor applied only to national average unit costs; not applied to local unit costs such as from vendors or Means.

Overhead and Profit (O&P)

General	25%	Typical general contractor overhead and profit
Means	-	NA
RACER	25%	NA
Contractor quote	5%	Prime contractor markup
Professional judgment	-	Not marked-up

Inflation 2.08% Avg. annual inflation from 2010 to 2015

Table B-3					
Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Construction Subtotal</b>				<b>\$ 6,620,126</b>
	<b>Site Preparation</b>				<b>\$ 15,000</b>
1	Temporary facilities	1.0	ls	\$ 15,000.00	\$ 15,000
	<b>Asbestos Survey</b>				<b>\$ 8,703</b>
2	Asbestos survey	1.0	ls	\$ 8,702.50	\$ 8,703
	<b>Equipment Decontamination</b>				<b>\$ 81,685</b>
3	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 69,645.00	\$ 69,645
4	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Asbestos Removal and Disposal</b>				<b>\$ 603,711</b>
5	Asbestos removal - Office Building	1.0	ls	\$ 86,733.75	\$ 86,734
6	Asbestos removal - Production Building	1.0	ls	\$ 170,078.75	\$ 170,079
7	Asbestos removal - Building 1	1.0	ls	\$ 43,548.75	\$ 43,549
8	Asbestos removal - Building 2	1.0	ls	\$ 209,323.75	\$ 209,324
9	Asbestos removal - Building 3	1.0	ls	\$ 94,025.00	\$ 94,025
	<b>PCB Removal and Disposal</b>				<b>\$ 330,886</b>
10	PCB removal - Building 2	1.0	ls	\$ 81,773.75	\$ 81,774
11	PCB removal - Building 3	1.0	ls	\$ 133,537.50	\$ 133,538
12	PCB disposal	424.0	ton	\$ 272.58	\$ 115,574
	<b>Metal Decontamination</b>				<b>\$ 96,478</b>
13	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 84,437.50	\$ 84,438
14	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Building Demolition</b>				<b>\$ 785,685</b>
15	Building demolition - Office Building	1.0	ls	\$ 76,375.84	\$ 76,376
16	Building demolition - Production Building	1.0	ls	\$ 504,541.80	\$ 504,542
17	Building demolition - Building 1	1.0	ls	\$ 14,489.11	\$ 14,489
18	Building demolition - Building 2	1.0	ls	\$ 137,498.69	\$ 137,499
19	Building demolition - Building 3	1.0	ls	\$ 51,387.91	\$ 51,388
20	Building demolition - Walkway	1.0	ls	\$ 1,390.95	\$ 1,391

**Appendix B**  
**Cost Savings - Non-hazardous Debris Disposal in SPA**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table B-3					
Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Slab Demolition</b>				<b>\$ 529,227</b>
21	Slab demolition - Office Building	1.0	ls	\$ 26,489.16	\$ 26,489
22	Slab demolition - Production Building	1.0	ls	\$ 241,586.65	\$ 241,587
23	Slab demolition - Building 1	1.0	ls	\$ 5,913.90	\$ 5,914
24	Slab demolition - Building 2	1.0	ls	\$ 56,116.11	\$ 56,116
25	Slab demolition - Building 3	1.0	ls	\$ 30,169.46	\$ 30,169
26	Slab demolition - Maintenance Building	1.0	ls	\$ 18,102.16	\$ 18,102
27	Slab demolition - Buildings 4 and 5	1.0	ls	\$ 150,849.76	\$ 150,850
	<b>Waste Characterization</b>				<b>\$ 88,641</b>
28	Sampling and analysis for pesticides, PCBs, and VOCs (building debris and wastewater)	1.0	ls	\$ 88,641.25	\$ 88,641
	<b>Transportation and Disposal</b>				<b>\$ 2,024,376</b>
29	Dump charges (non-hazardous waste)	21,407.0	ton	\$ 38.29	\$ 819,686
30	Load and haul (non-hazardous waste)	21,407.0	ton	\$ 21.46	\$ 459,455
31	Transportation and disposal (hazardous)	2,734.0	ton	\$ 272.58	\$ 745,235
	<b>Capping</b>				<b>\$ 1,891,076</b>
32	Asphalt pavement - 6 inch base course layer, 3 inch topping	40,463.0	sy	\$ 46.60	\$ 1,885,576
33	Cap material sampling and analysis (every 500 ft)	2.0	ea	\$ 2,000.00	\$ 4,000
34	Cap thickness verification (every 100 ft)	10.0	ea	\$ 150.00	\$ 1,500
	<b>Crushing</b>				<b>\$ 103,212</b>
35	Bulldozer (crushing non-hazardous debris for fill)	160.0	hr	\$ 267.40	\$ 42,784
36	Backhoe, 0.75 CY (crushing non-hazardous debris for fill)	160.0	hr	\$ 142.55	\$ 22,808
37	Jackhammer (crushing of non-hazardous debris for fill)	160.0	hr	\$ 235.13	\$ 37,620
	<b>Measurement</b>				<b>\$ 61,446</b>
38	Pre-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
39	Post-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
Construction subtotal				\$	6,620,126
Construction Contractor Mobe/Demobe, Site Prep and Submittals				10%	\$ 662,013
Pre-design investigation				10%	\$ 662,013
Engineering design				18%	\$ 1,191,623
Project management and construction oversight				7%	\$ 463,409
Recycling of metal (15,547 tons at \$90 per ton)					\$ (1,399,230)
<b>Capital Cost Subtotal</b>				<b>\$</b>	<b>8,199,953</b>

Appendix B  
Cost Savings - Non-hazardous Debris Disposal in SPA  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

Table B-4					
Institutional Controls					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Institutional Controls Subtotal</b>				<b>\$ 42,500</b>
40	Prepare LUC Implementation Plan (mid-level staff with senior review)	250	hr	\$ 110.00	\$ 27,500
41	Meetings with agencies (senior staff and attorneys)	60	hr	\$ 250.00	\$ 15,000

Operation and Maintenance

Table B-5					
Operation and Maintenance					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Annual Operation and Maintenance Subtotal</b>				<b>\$ 38,149</b>
	<b>Cap Monitoring</b>				<b>\$ 9,500</b>
42	Engineer site visit (1 per year)	1.0	ls	\$ 3,500.00	\$ 3,500
43	Proj. Mgmt. 2 hrs/wk on proj for 24 weeks	48.0	hr	\$ 125.00	\$ 6,000
	<b>Cap Repair (every 3 years)</b>				<b>\$ 70,947</b>
44	Seal coat	364,167.0	sf	\$ 0.17	\$ 62,382
45	Crack sealing	10,000.0	lf	\$ 0.86	\$ 8,565
	<b>Five-Year Review (every 5 years)</b>				<b>\$ 25,000</b>
46	Five-year review	1.0	ls	\$ 25,000.00	\$ 25,000

Notes:  
ea Each  
hr Hour  
lf Linear foot  
ls Lump sum  
sf Square foot  
sy Square yard

Appendix B  
Cost Savings - Non-hazardous Debris Disposal in SPA  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

ALTERNATIVE 2B  
BUILDING DEMOLITION WITH OFF-SITE DISPOSAL (75% HAZARDOUS)

Table B-6				
Alternative 2B - Building Demolition with Off-site Disposal (75% Hazardous)				
Source	Description	Subtotal	Contingency	Total (Rounded)
Table B-7	Design and Construction	\$ 9,491,532	\$ 2,847,459	\$ 12,339,000
Table B-8	Institutional Controls	\$ 42,500	\$ 12,750	\$ 55,000
Table B-9	Operation and Maintenance	\$ 445,676	\$ 133,703	\$ 579,000
Contingency		30%	\$ 2,993,912	
Total			\$ 12,973,000	

Appendix B  
Cost Savings - Non-hazardous Debris Disposal in SPA  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

Capital Cost

Location factor (for zip code 433xx)

ECHOS	1
Get-a-Quote	1.04

Note: Location factor applied only to national average unit costs; not applied to local unit costs such as from vendors or Means.

Overhead and Profit (O&P)

General	25%	Typical general contractor overhead and profit
Means	-	NA
RACER	25%	NA
Contractor quote	5%	Prime contractor markup
Professional judgment	-	Not marked-up

Inflation 2.08% Avg. annual inflation from 2010 to 2015

Table B-7					
Alternative 2B - Building Demolition with Off-site Disposal (75% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Construction Subtotal</b>				<b>\$ 7,510,870</b>
	<b>Site Preparation</b>				<b>\$ 15,000</b>
1	Temporary facilities	1.0	ls	\$ 15,000.00	\$ 15,000
	<b>Asbestos Survey</b>				<b>\$ 8,703</b>
2	Asbestos survey	1.0	ls	\$ 8,702.50	\$ 8,703
	<b>Equipment Decontamination</b>				<b>\$ 81,685</b>
3	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 69,645.00	\$ 69,645
4	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Asbestos Removal and Disposal</b>				<b>\$ 603,711</b>
5	Asbestos removal - Office Building	1.0	ls	\$ 86,733.75	\$ 86,734
6	Asbestos removal - Production Building	1.0	ls	\$ 170,078.75	\$ 170,079
7	Asbestos removal - Building 1	1.0	ls	\$ 43,548.75	\$ 43,549
8	Asbestos removal - Building 2	1.0	ls	\$ 209,323.75	\$ 209,324
9	Asbestos removal - Building 3	1.0	ls	\$ 94,025.00	\$ 94,025
	<b>PCB Removal and Disposal</b>				<b>\$ 330,886</b>
10	PCB removal - Building 2	1.0	ls	\$ 81,773.75	\$ 81,774
11	PCB removal - Building 3	1.0	ls	\$ 133,537.50	\$ 133,538
12	PCB disposal	424.0	ton	\$ 272.58	\$ 115,574
	<b>Metal Decontamination</b>				<b>\$ 96,478</b>
13	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 84,437.50	\$ 84,438
14	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Building Demolition</b>				<b>\$ 785,685</b>
15	Building demolition - Office Building	1.0	ls	\$ 76,375.84	\$ 76,376
16	Building demolition - Production Building	1.0	ls	\$ 504,541.80	\$ 504,542
17	Building demolition - Building 1	1.0	ls	\$ 14,489.11	\$ 14,489
18	Building demolition - Building 2	1.0	ls	\$ 137,498.69	\$ 137,499
19	Building demolition - Building 3	1.0	ls	\$ 51,387.91	\$ 51,388
20	Building demolition - Walkway	1.0	ls	\$ 1,390.95	\$ 1,391

**Appendix B**  
**Cost Savings - Non-hazardous Debris Disposal in SPA**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table B-7					
Alternative 2B - Building Demolition with Off-site Disposal (75% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Slab Demolition</b>				<b>\$ 529,227</b>
21	Slab demolition - Office Building	1.0	ls	\$ 26,489.16	\$ 26,489
22	Slab demolition - Production Building	1.0	ls	\$ 241,586.65	\$ 241,587
23	Slab demolition - Building 1	1.0	ls	\$ 5,913.90	\$ 5,914
24	Slab demolition - Building 2	1.0	ls	\$ 56,116.11	\$ 56,116
25	Slab demolition - Building 3	1.0	ls	\$ 30,169.46	\$ 30,169
26	Slab demolition - Maintenance Building	1.0	ls	\$ 18,102.16	\$ 18,102
27	Slab demolition - Buildings 4 and 5	1.0	ls	\$ 150,849.76	\$ 150,850
	<b>Waste Characterization</b>				<b>\$ 88,641</b>
28	Sampling and analysis for pesticides, PCBs, and VOCs (building debris and wastewater)	1.0	ls	\$ 88,641.25	\$ 88,641
	<b>Transportation and Disposal</b>				<b>\$ 2,915,120</b>
29	Dump charges (non-hazardous waste)	17,921.0	ton	\$ 38.29	\$ 686,205
30	Load and haul (non-hazardous waste)	17,921.0	ton	\$ 21.46	\$ 384,636
31	Transportation and disposal (hazardous)	6,766.0	ton	\$ 272.58	\$ 1,844,279
	<b>Capping</b>				<b>\$ 1,891,076</b>
32	Asphalt pavement - 6 inch base course layer, 3 inch topping	40,463.0	sy	\$ 46.60	\$ 1,885,576
33	Cap material sampling and analysis (every 500 ft)	2.0	ea	\$ 2,000.00	\$ 4,000
34	Cap thickness verification (every 100 ft)	10.0	ea	\$ 150.00	\$ 1,500
	<b>Crushing</b>				<b>\$ 103,212</b>
35	Bulldozer (crushing non-hazardous debris for fill)	160.0	hr	\$ 267.40	\$ 42,784
36	Backhoe, 0.75 CY (crushing non-hazardous debris for fill)	160.0	hr	\$ 142.55	\$ 22,808
37	Jackhammer (crushing of non-hazardous debris for fill)	160.0	hr	\$ 235.13	\$ 37,620
	<b>Measurement</b>				<b>\$ 61,446</b>
38	Pre-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
39	Post-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
Construction subtotal					\$ 7,510,870
Construction Contractor Mobe/Demobe, Site Prep and Submittals					\$ 751,087.00
Pre-design investigation					\$ 751,087.00
Engineering design					\$ 1,351,956.60
Project management and construction oversight					\$ 525,760.90
Recycling of metal (15,547 tons at \$90 per ton)					\$ (1,399,230.00)
<b>Capital Cost Subtotal</b>					<b>\$ 9,491,532</b>

Appendix B  
Cost Savings - Non-hazardous Debris Disposal in SPA  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

Table B-8					
Institutional Controls					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	Institutional Controls Subtotal				\$ 42,500
40	Prepare LUC Implementation Plan (mid-level staff with senior review)	250	hr	\$ 110.00	\$ 27,500
41	Meetings with agencies (senior staff and attorneys)	60	hr	\$ 250.00	\$ 15,000

Operation and Maintenance

Table B-9					
Operation and Maintenance					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	Annual Operation and Maintenance Subtotal				\$ 38,149
	Cap Monitoring				\$ 9,500
42	Engineer site visit (1 per year)	1.0	ls	\$ 3,500.00	\$ 3,500
43	Proj. Mgmt. 2 hrs/wk on proj for 24 weeks	48.0	hr	\$ 125.00	\$ 6,000
	Cap Repair (every 3 years)				\$ 70,947
44	Seal coat	364,167.0	sf	\$ 0.17	\$ 62,382
45	Crack sealing	10,000.0	lf	\$ 0.86	\$ 8,565
	Five-Year Review (every 5 years)				\$ 25,000
46	Five-year review	1.0	ls	\$ 25,000.00	\$ 25,000

Notes:

ea	Each
hr	Hour
lf	Linear foot
ls	Lump sum
sf	Square foot
sy	Square yard



**Appendix B**  
**Cost Savings - Non-hazardous Debris Disposal in SPA**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Annual Discount Rate <sup>1</sup>:

30-Yr 7.00%

Table B-10						
Present Value Analysis						
Year	Annual Discount Factor <sup>2</sup>	Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)				
		Operation and Maintenance Costs				
	30-Yr	Description	Future Cost <sup>3</sup>	Description	Future Cost <sup>3</sup>	Present Value (2015)
0	1.000					\$0
1	0.935	Cap O&M	\$9,500			\$8,879
2	0.873	Cap O&M	\$9,500			\$8,298
3	0.816	Cap O&M	\$80,447			\$65,669
4	0.763	Cap O&M	\$9,500			\$7,248
5	0.713	Cap O&M	\$9,500	Five-Year Review	\$25,000	\$24,598
6	0.666	Cap O&M	\$80,447			\$53,605
7	0.623	Cap O&M	\$9,500			\$5,916
8	0.582	Cap O&M	\$9,500			\$5,529
9	0.544	Cap O&M	\$80,447			\$43,758
10	0.508	Cap O&M	\$9,500	Five-Year Review	\$25,000	\$17,538
11	0.475	Cap O&M	\$9,500			\$4,513
12	0.444	Cap O&M	\$80,447			\$35,719
13	0.415	Cap O&M	\$9,500			\$3,942
14	0.388	Cap O&M	\$9,500			\$3,684
15	0.362	Cap O&M	\$80,447	Five-Year Review	\$25,000	\$38,219
16	0.339	Cap O&M	\$9,500			\$3,218
17	0.317	Cap O&M	\$9,500			\$3,007
18	0.296	Cap O&M	\$80,447			\$23,801
19	0.277	Cap O&M	\$9,500			\$2,627
20	0.258	Cap O&M	\$9,500	Five-Year Review	\$25,000	\$8,915
21	0.242	Cap O&M	\$80,447			\$19,429
22	0.226	Cap O&M	\$9,500			\$2,144
23	0.211	Cap O&M	\$9,500			\$2,004
24	0.197	Cap O&M	\$80,447			\$15,860
25	0.184	Cap O&M	\$9,500	Five-Year Review	\$25,000	\$6,357
26	0.172	Cap O&M	\$9,500			\$1,636
27	0.161	Cap O&M	\$80,447			\$12,946
28	0.150	Cap O&M	\$9,500			\$1,429
29	0.141	Cap O&M	\$9,500			\$1,335
30	0.131	Cap O&M	\$80,447	Five-Year Review	\$25,000	\$13,852
<b>Total Present Value of Periodic Cost</b>						<b>\$445,676</b>

Notes:

1 From "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000)

2 Annual discount factor =  $1/(1+i)^t$ , where i = discount rate (includes inflation and interest) and t = year

3 Current dollar cost of future event

O&M Operations and maintenance

**Appendix B**  
**Cost Savings - Non-hazardous Debris Disposal in SPA**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table B-11						
Present Value Analysis						
Year	Annual Discount Factor <sup>2</sup>	Alternative 2B - Building Demolition with Off-site Disposal (75% Hazardous)				
		Operation and Maintenance Costs				
	30-Yr	Description	Future Cost <sup>3</sup>	Description	Future Cost <sup>3</sup>	Present Value (2015)
0	1.000					\$0
1	0.935	Cap O&M	\$9,500			\$8,879
2	0.873	Cap O&M	\$9,500			\$8,298
3	0.816	Cap O&M	\$80,447			\$65,669
4	0.763	Cap O&M	\$9,500			\$7,248
5	0.713	Cap O&M	\$9,500	Five-Year Review	\$25,000	\$24,598
6	0.666	Cap O&M	\$80,447			\$53,605
7	0.623	Cap O&M	\$9,500			\$5,916
8	0.582	Cap O&M	\$9,500			\$5,529
9	0.544	Cap O&M	\$80,447			\$43,758
10	0.508	Cap O&M	\$9,500	Five-Year Review	\$25,000	\$17,538
11	0.475	Cap O&M	\$9,500			\$4,513
12	0.444	Cap O&M	\$80,447			\$35,719
13	0.415	Cap O&M	\$9,500			\$3,942
14	0.388	Cap O&M	\$9,500			\$3,684
15	0.362	Cap O&M	\$80,447	Five-Year Review	\$25,000	\$38,219
16	0.339	Cap O&M	\$9,500			\$3,218
17	0.317	Cap O&M	\$9,500			\$3,007
18	0.296	Cap O&M	\$80,447			\$23,801
19	0.277	Cap O&M	\$9,500			\$2,627
20	0.258	Cap O&M	\$9,500	Five-Year Review	\$25,000	\$8,915
21	0.242	Cap O&M	\$80,447			\$19,429
22	0.226	Cap O&M	\$9,500			\$2,144
23	0.211	Cap O&M	\$9,500			\$2,004
24	0.197	Cap O&M	\$80,447			\$15,860
25	0.184	Cap O&M	\$9,500	Five-Year Review	\$25,000	\$6,357
26	0.172	Cap O&M	\$9,500			\$1,636
27	0.161	Cap O&M	\$80,447			\$12,946
28	0.150	Cap O&M	\$9,500			\$1,429
29	0.141	Cap O&M	\$9,500			\$1,335
30	0.131	Cap O&M	\$80,447	Five-Year Review	\$25,000	\$13,852
<b>Total Present Value of Periodic Cost</b>						<b>\$445,676</b>

Notes:

1 From "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000)

2 Annual discount factor =  $1/(1+i)^t$ , where i = discount rate (includes inflation and interest) and t = year

3 Current dollar cost of future event

O&M Operations and maintenance

**Appendix B**  
**Cost Savings - Berm Design**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

TABLE B-1						
COST SUMMARY						
Alternative	Option	Description	Capital Cost	Institutional Controls	Operation & Maintenance	Total
2A	NA	Building Demolition with Off-site Disposal (25% Hazardous)	\$ 11,089,000	\$ 55,000	\$ 1,074,000	\$ 12,218,000
2B	NA	Building Demolition with Off-site Disposal (75% Hazardous)	\$ 12,820,000	\$ 55,000	\$ 1,027,000	\$ 13,902,000

Appendix B  
Cost Savings - Berm Design  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

ALTERNATIVE 2A  
BUILDING DEMOLITION WITH OFF-SITE DISPOSAL (25% HAZARDOUS)

Table B-2				
Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)				
Source	Description	Subtotal	Contingency	Total (Rounded)
Table B-3	Design and Construction	\$ 8,530,366	\$ 2,559,109.70	\$ 11,089,000
Table B-4	Institutional Controls	\$ 42,500	\$ 12,750	\$ 55,000
Table B-5	Operation and Maintenance	\$ 826,448	\$ 247,934.32	\$ 1,074,000
Contingency		30%	\$ 2,819,794.01	
Total			\$	12,218,000

**Appendix B**  
**Cost Savings - Berm Design**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

**Capital Cost**

Location factor (for zip code 433xx)

ECHOS	1
Get-a-Quote	1.04

Note: Location factor applied only to national average unit costs; not applied to local unit costs such as from vendors or Means.

Overhead and Profit (O&P)

General	25%	Typical general contractor overhead and profit
Means	-	NA
RACER	25%	NA
Contractor quote	5%	Prime contractor markup
Professional judgment	-	Not marked-up

Inflation 2.08% Avg. annual inflation from 2010 to 2015

Table B-3					
Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Construction Subtotal</b>				<b>\$ 6,847,997</b>
	<b>Site Preparation</b>				<b>\$ 15,000</b>
1	Temporary facilities	1.0	ls	\$ 15,000.00	\$ 15,000
	<b>Asbestos Survey</b>				<b>\$ 8,703</b>
2	Asbestos survey	1.0	ls	\$ 8,702.50	\$ 8,703
	<b>Equipment Decontamination</b>				<b>\$ 81,685</b>
3	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 69,645.00	\$ 69,645
4	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Asbestos Removal and Disposal</b>				<b>\$ 603,711</b>
5	Asbestos removal - Office Building	1.0	ls	\$ 86,733.75	\$ 86,734
6	Asbestos removal - Production Building	1.0	ls	\$ 170,078.75	\$ 170,079
7	Asbestos removal - Building 1	1.0	ls	\$ 43,548.75	\$ 43,549
8	Asbestos removal - Building 2	1.0	ls	\$ 209,323.75	\$ 209,324
9	Asbestos removal - Building 3	1.0	ls	\$ 94,025.00	\$ 94,025
	<b>PCB Removal and Disposal</b>				<b>\$ 330,886</b>
10	PCB removal - Building 2	1.0	ls	\$ 81,773.75	\$ 81,774
11	PCB removal - Building 3	1.0	ls	\$ 133,537.50	\$ 133,538
12	PCB disposal	424.0	tons	\$ 272.58	\$ 115,574
	<b>Metal Decontamination</b>				<b>\$ 96,478</b>
13	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 84,437.50	\$ 84,438
14	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Building Demolition</b>				<b>\$ 785,685</b>
15	Building demolition - Office Building	1.0	ls	\$ 76,375.84	\$ 76,376
16	Building demolition - Production Building	1.0	ls	\$ 504,541.80	\$ 504,542
17	Building demolition - Building 1	1.0	ls	\$ 14,489.11	\$ 14,489
18	Building demolition - Building 2	1.0	ls	\$ 137,498.69	\$ 137,499
19	Building demolition - Building 3	1.0	ls	\$ 51,387.91	\$ 51,388
20	Building demolition - Walkway	1.0	ls	\$ 1,390.95	\$ 1,391

**Appendix B**  
**Cost Savings - Berm Design**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table B-3					
Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Slab Demolition</b>				<b>\$ 529,227</b>
21	Slab demolition - Office Building	1.0	ls	\$ 26,489.16	\$ 26,489
22	Slab demolition - Production Building	1.0	ls	\$ 241,586.65	\$ 241,587
23	Slab demolition - Building 1	1.0	ls	\$ 5,913.90	\$ 5,914
24	Slab demolition - Building 2	1.0	ls	\$ 56,116.11	\$ 56,116
25	Slab demolition - Building 3	1.0	ls	\$ 30,169.46	\$ 30,169
26	Slab demolition - Maintenance Building	1.0	ls	\$ 18,102.16	\$ 18,102
27	Slab demolition - Buildings 4 and 5	1.0	ls	\$ 150,849.76	\$ 150,850
	<b>Waste Characterization</b>				<b>\$ 88,641</b>
28	Sampling and analysis for pesticides, PCBs, and VOCs (building debris and wastewater)	1.0	ls	\$ 88,641.25	\$ 88,641
	<b>Transportation and Disposal</b>				<b>\$ 745,235</b>
29	Dump charges (non-hazardous waste)	0.0	ton	\$ 38.29	\$ -
30	Load and haul (non-hazardous waste)	0.0	ton	\$ 21.46	\$ -
31	Transportation and disposal (hazardous)	2,734.0	ton	\$ 272.58	\$ 745,235
	<b>Walking Path</b>				<b>\$ 1,507,012</b>
32	Clay, low permeability, 6 inches deep	10,624.0	cy	\$ 37.84	\$ 401,986
33	Fill, 6 inches deep	9,486.0	cy	\$ 34.89	\$ 330,943
34	Topsoil, 6 inches deep	9,486.0	lcy	\$ 51.00	\$ 483,786
35	Seeding, vegetative cover	9.4	ac	\$ 4,993.48	\$ 46,989
36	Sidewalk, 4 inches deep with mesh	35,979.0	sf	\$ 6.76	\$ 243,308
	<b>Capping</b>				<b>\$ 1,891,076</b>
32	Asphalt pavement - 6 inch base course layer, 3 inch topping	40,463.0	sy	\$ 46.60	\$ 1,885,576
33	Cap material sampling and analysis (every 500 ft)	2.0	ea	\$ 2,000.00	\$ 4,000
34	Cap thickness verification (every 100 ft)	10.0	ea	\$ 150.00	\$ 1,500
	<b>Crushing</b>				<b>\$ 103,212</b>
35	Bulldozer (crushing non-hazardous debris for fill)	160.0	hour	\$ 267.40	\$ 42,784
36	Backhoe, 0.75 CY (crushing non-hazardous debris for fill)	160.0	hour	\$ 142.55	\$ 22,808
37	Jackhammer (crushing of non-hazardous debris for fill)	160.0	hour	\$ 235.13	\$ 37,620
	<b>Measurement</b>				<b>\$ 61,446</b>
38	Pre-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
39	Post-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
Construction subtotal				\$	6,847,997
Construction Contractor Mobe/Demobe, Site Prep and Submittals				10%	\$ 684,799.70
Pre-design investigation				10%	\$ 684,799.70
Engineering design				18%	\$ 1,232,639.46
Project management and construction oversight				7%	\$ 479,359.79
Recycling of metal (15,547 tons at \$90 per ton)					\$ (1,399,230.00)
<b>Capital Cost Subtotal</b>				<b>\$</b>	<b>8,530,366</b>

Appendix B  
Cost Savings - Berm Design  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

Table B-4					
Institutional Controls					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Institutional Controls Subtotal</b>				<b>\$ 42,500</b>
40	Prepare LUC Implementation Plan (mid-level staff with senior review)	250	hr	\$ 110.00	\$ 27,500
41	Meetings with agencies (senior staff and attorneys)	60	hr	\$ 250.00	\$ 15,000

Operation and Maintenance

Table B-5					
Operation and Maintenance					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Annual Operation and Maintenance Subtotal</b>				<b>\$ 63,834</b>
	<b>Cap Monitoring</b>				<b>\$ 9,500</b>
42	Engineer site visit (1 per year)	1.0	ls	\$ 3,500.00	\$ 3,500
43	Proj. Mgmt. 2 hrs/wk on proj for 24 weeks	48.0	hr	\$ 125.00	\$ 6,000
	<b>Cap Repair (every 3 years)</b>				<b>\$ 70,947</b>
44	Seal coat	364,167.0	sf	\$ 0.17	\$ 62,382
45	Crack sealing	10,000.0	lf	\$ 0.86	\$ 8,565

Appendix B  
Cost Savings - Berm Design  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

ALTERNATIVE 2B  
BUILDING DEMOLITION WITH OFF-SITE DISPOSAL (75% HAZARDOUS)

Table B-6				
Alternative 2B - Building Demolition with Off-site Disposal (75% Hazardous)				
Source	Description	Subtotal	Contingency	Total (Rounded)
Table B-7	Design and Construction	\$ 9,861,689	\$ 2,958,506.69	\$ 12,820,000
Table B-8	Institutional Controls	\$ 42,500	\$ 12,750	\$ 55,000
Table B-9	Operation and Maintenance	\$ 789,891	\$ 236,967.21	\$ 1,027,000
Contingency		30%	\$ 3,208,223.89	
Total			\$ 13,902,000	



**Appendix B**  
**Cost Savings - Berm Design**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

**Capital Cost**

Location factor (for zip code 433xx)

ECHOS	1
Get-a-Quote	1.04

Note: Location factor applied only to national average unit costs; not applied to local unit costs such as from vendors or Means.

Overhead and Profit (O&P)

General	25%	Typical general contractor overhead and profit
Means	-	NA
RACER	25%	NA
Contractor quote	5%	Prime contractor markup
Professional judgment	-	Not marked-up

Inflation 2.08% Avg. annual inflation from 2010 to 2015

Table B-7					
Alternative 2A - Building Demolition with Off-site Disposal (75% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Construction Subtotal</b>				<b>\$ 7,766,151</b>
	<b>Site Preparation</b>				<b>\$ 15,000</b>
1	Temporary facilities	1.0	ls	\$ 15,000.00	\$ 15,000
	<b>Asbestos Survey</b>				<b>\$ 8,703</b>
2	Asbestos survey	1.0	ls	\$ 8,702.50	\$ 8,703
	<b>Equipment Decontamination</b>				<b>\$ 81,685</b>
3	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 69,645.00	\$ 69,645
4	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Asbestos Removal and Disposal</b>				<b>\$ 603,711</b>
5	Asbestos removal - Office Building	1.0	ls	\$ 86,733.75	\$ 86,734
6	Asbestos removal - Production Building	1.0	ls	\$ 170,078.75	\$ 170,079
7	Asbestos removal - Building 1	1.0	ls	\$ 43,548.75	\$ 43,549
8	Asbestos removal - Building 2	1.0	ls	\$ 209,323.75	\$ 209,324
9	Asbestos removal - Building 3	1.0	ls	\$ 94,025.00	\$ 94,025
	<b>PCB Removal and Disposal</b>				<b>\$ 330,886</b>
10	PCB removal - Building 2	1.0	ls	\$ 81,773.75	\$ 81,774
11	PCB removal - Building 3	1.0	ls	\$ 133,537.50	\$ 133,538
12	PCB disposal	424.0	tons	\$ 272.58	\$ 115,574
	<b>Metal Decontamination</b>				<b>\$ 96,478</b>
13	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 84,437.50	\$ 84,438
14	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Building Demolition</b>				<b>\$ 785,685</b>
15	Building demolition - Office Building	1.0	ls	\$ 76,375.84	\$ 76,376
16	Building demolition - Production Building	1.0	ls	\$ 504,541.80	\$ 504,542
17	Building demolition - Building 1	1.0	ls	\$ 14,489.11	\$ 14,489
18	Building demolition - Building 2	1.0	ls	\$ 137,498.69	\$ 137,499
19	Building demolition - Building 3	1.0	ls	\$ 51,387.91	\$ 51,388
20	Building demolition - Walkway	1.0	ls	\$ 1,390.95	\$ 1,391

**Appendix B**  
**Cost Savings - Berm Design**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table B-7					
Alternative 2A - Building Demolition with Off-site Disposal (75% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Slab Demolition</b>				<b>\$ 529,227</b>
21	Slab demolition - Office Building	1.0	ls	\$ 26,489.16	\$ 26,489
22	Slab demolition - Production Building	1.0	ls	\$ 241,586.65	\$ 241,587
23	Slab demolition - Building 1	1.0	ls	\$ 5,913.90	\$ 5,914
24	Slab demolition - Building 2	1.0	ls	\$ 56,116.11	\$ 56,116
25	Slab demolition - Building 3	1.0	ls	\$ 30,169.46	\$ 30,169
26	Slab demolition - Maintenance Building	1.0	ls	\$ 18,102.16	\$ 18,102
27	Slab demolition - Buildings 4 and 5	1.0	ls	\$ 150,849.76	\$ 150,850
	<b>Waste Characterization</b>				<b>\$ 88,641</b>
28	Sampling and analysis for pesticides, PCBs, and VOCs (building debris and wastewater)	1.0	ls	\$ 88,641.25	\$ 88,641
	<b>Transportation and Disposal</b>				<b>\$ 1,844,279</b>
29	Dump charges (non-hazardous waste)	0.0	ton	\$ 38.29	\$ -
30	Load and haul (non-hazardous waste)	0.0	ton	\$ 21.46	\$ -
31	Transportation and disposal (hazardous)	6,766.0	ton	\$ 272.58	\$ 1,844,279
	<b>Walking Path</b>				<b>\$ 1,326,122</b>
32	Clay, low permeability, 6 inches deep	9,104.0	cy	\$ 37.84	\$ 344,473
33	Fill, 6 inches deep	8,128.0	cy	\$ 34.89	\$ 283,566
34	Topsoil, 6 inches deep	8,128.0	lcy	\$ 51.00	\$ 414,528
35	Seeding, vegetative cover	8.1	ac	\$ 4,993.48	\$ 40,247
36	Sidewalk, 4 inches deep with mesh	35,979.0	sf	\$ 6.76	\$ 243,308
	<b>Capping</b>				<b>\$ 1,891,076</b>
32	Asphalt pavement - 6 inch base course layer, 3 inch topping	40,463.0	sy	\$ 46.60	\$ 1,885,576
33	Cap material sampling and analysis (every 500 ft)	2.0	ea	\$ 2,000.00	\$ 4,000
34	Cap thickness verification (every 100 ft)	10.0	ea	\$ 150.00	\$ 1,500
	<b>Crushing</b>				<b>\$ 103,212</b>
35	Bulldozer (crushing non-hazardous debris for fill)	160.0	hour	\$ 267.40	\$ 42,784
36	Backhoe, 0.75 CY (crushing non-hazardous debris for fill)	160.0	hour	\$ 142.55	\$ 22,808
37	Jackhammer (crushing of non-hazardous debris for fill)	160.0	hour	\$ 235.13	\$ 37,620
	<b>Measurement</b>				<b>\$ 61,446</b>
38	Pre-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
39	Post-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
Construction subtotal					\$ 7,766,151
Construction Contractor Mobe/Demobe, Site Prep and Submittals					\$ 776,615.10
Pre-design investigation					\$ 776,615.10
Engineering design					\$ 1,397,907.18
Project management and construction oversight					\$ 543,630.57
Recycling of metal (15,547 tons at \$90 per ton)					\$ (1,399,230.00)
<b>Capital Cost Subtotal</b>					<b>\$ 9,861,689</b>

Appendix B  
Cost Savings - Berm Design  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

Table B-8					
Institutional Controls					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	Institutional Controls Subtotal				\$ 42,500
40	Prepare LUC Implementation Plan (mid-level staff with senior review)	250	hr	\$ 110.00	\$ 27,500
41	Meetings with agencies (senior staff and attorneys)	60	hr	\$ 250.00	\$ 15,000

Operation and Maintenance

Table B-9					
Operation and Maintenance					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	Annual Operation and Maintenance Subtotal				\$ 60,888
	Cap Monitoring				\$ 9,500
42	Engineer site visit (1 per year)	1.0	ls	\$ 3,500.00	\$ 3,500
43	Proj. Mgmt. 2 hrs/wk on proj for 24 weeks	48.0	hr	\$ 125.00	\$ 6,000
	Cap Repair (every 3 years)				\$ 70,947
44	Seal coat	364,167.0	sf	\$ 0.17	\$ 62,382
45	Crack sealing	10,000.0	lf	\$ 0.86	\$ 8,565
	Walking Path Repair				\$ 27,739
46	Re-seeding (25 percent of berm)	2.0	acre	\$ 4,993.48	\$ 9,987
47	Fertilization	8.1	acre	\$ 921.16	\$ 7,461
48	Erosion repair	1.0	ls	\$ 2,500.00	\$ 2,500
49	Crack sealing	1,200.0	lf	\$ 0.86	\$ 1,028
50	Concrete replacement	1,000.0	sf	\$ 6.76	\$ 6,763

**Appendix B**  
**Cost Savings - Berm Design**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Annual Discount Rate <sup>1</sup>:

30-Yr 7.00%

Table B-10						
Present Value Analysis						
Year	Annual Discount Factor <sup>2</sup>	Alternative 2A - Building Demolition with Off-site Disposal (25% Hazardous)				
		Operation and Maintenance Costs				
	30-Yr	Description	Future Cost <sup>3</sup>	Description	Future Cost <sup>3</sup>	Present Value (2015)
0	1.000					\$0
1	0.935	Cap O&M	\$40,185			\$37,556
2	0.873	Cap O&M	\$40,185			\$35,099
3	0.816	Cap O&M	\$111,132			\$90,717
4	0.763	Cap O&M	\$40,185			\$30,657
5	0.713	Cap O&M	\$40,185	Five-Year Review	\$25,000	\$46,476
6	0.666	Cap O&M	\$111,132			\$74,052
7	0.623	Cap O&M	\$40,185			\$25,025
8	0.582	Cap O&M	\$40,185			\$23,388
9	0.544	Cap O&M	\$111,132			\$60,448
10	0.508	Cap O&M	\$40,185	Five-Year Review	\$25,000	\$33,137
11	0.475	Cap O&M	\$40,185			\$19,092
12	0.444	Cap O&M	\$111,132			\$49,344
13	0.415	Cap O&M	\$40,185			\$16,675
14	0.388	Cap O&M	\$40,185			\$15,584
15	0.362	Cap O&M	\$111,132	Five-Year Review	\$25,000	\$49,341
16	0.339	Cap O&M	\$40,185			\$13,612
17	0.317	Cap O&M	\$40,185			\$12,722
18	0.296	Cap O&M	\$111,132			\$32,880
19	0.277	Cap O&M	\$40,185			\$11,111
20	0.258	Cap O&M	\$40,185	Five-Year Review	\$25,000	\$16,845
21	0.242	Cap O&M	\$111,132			\$26,840
22	0.226	Cap O&M	\$40,185			\$9,070
23	0.211	Cap O&M	\$40,185			\$8,477
24	0.197	Cap O&M	\$111,132			\$21,909
25	0.184	Cap O&M	\$40,185	Five-Year Review	\$25,000	\$12,010
26	0.172	Cap O&M	\$40,185			\$6,920
27	0.161	Cap O&M	\$111,132			\$17,885
28	0.150	Cap O&M	\$40,185			\$6,044
29	0.141	Cap O&M	\$40,185			\$5,649
30	0.131	Cap O&M	\$111,132	Five-Year Review	\$25,000	\$17,883
<b>Total Present Value of Periodic Cost</b>						<b>\$826,448</b>

Notes:

1 From "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000)

2 Annual discount factor =  $1/(1+i)^t$ , where i = discount rate (includes inflation and interest) and t = year

3 Current dollar cost of future event

O&M Operations and maintenance

**Appendix B**  
**Cost Savings - Berm Design**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table A-15						
Present Value Analysis						
Year	Annual Discount Factor <sup>2</sup>	Alternative 2B - Building Demolition with Off-site Disposal (75% Hazardous)				
		Operation and Maintenance Costs				Present Value (2015)
	30-Yr	Description	Future Cost <sup>3</sup>	Description	Future Cost <sup>3</sup>	
0	1.000					\$0
1	0.935	Cap O&M	\$37,239			\$34,803
2	0.873	Cap O&M	\$37,239			\$32,526
3	0.816	Cap O&M	\$108,186			\$88,312
4	0.763	Cap O&M	\$37,239			\$28,409
5	0.713	Cap O&M	\$37,239	Five-Year Review	\$25,000	\$44,376
6	0.666	Cap O&M	\$108,186			\$72,089
7	0.623	Cap O&M	\$37,239			\$23,191
8	0.582	Cap O&M	\$37,239			\$21,673
9	0.544	Cap O&M	\$108,186			\$58,846
10	0.508	Cap O&M	\$37,239	Five-Year Review	\$25,000	\$31,639
11	0.475	Cap O&M	\$37,239			\$17,692
12	0.444	Cap O&M	\$108,186			\$48,036
13	0.415	Cap O&M	\$37,239			\$15,453
14	0.388	Cap O&M	\$37,239			\$14,442
15	0.362	Cap O&M	\$108,186	Five-Year Review	\$25,000	\$48,273
16	0.339	Cap O&M	\$37,239			\$12,614
17	0.317	Cap O&M	\$37,239			\$11,789
18	0.296	Cap O&M	\$108,186			\$32,008
19	0.277	Cap O&M	\$37,239			\$10,297
20	0.258	Cap O&M	\$37,239	Five-Year Review	\$25,000	\$16,084
21	0.242	Cap O&M	\$108,186			\$26,128
22	0.226	Cap O&M	\$37,239			\$8,405
23	0.211	Cap O&M	\$37,239			\$7,855
24	0.197	Cap O&M	\$108,186			\$21,329
25	0.184	Cap O&M	\$37,239	Five-Year Review	\$25,000	\$11,467
26	0.172	Cap O&M	\$37,239			\$6,412
27	0.161	Cap O&M	\$108,186			\$17,410
28	0.150	Cap O&M	\$37,239			\$5,601
29	0.141	Cap O&M	\$37,239			\$5,234
30	0.131	Cap O&M	\$108,186	Five-Year Review	\$25,000	\$17,496
<b>Total Present Value of Periodic Cost</b>						<b>\$789,891</b>

Notes:

1 From "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000)

2 Annual discount factor =  $1/(1+i)^t$ , where i = discount rate (includes inflation and interest) and t = year

3 Current dollar cost of future event

O&M Operations and maintenance

**ALTERNATIVE 3**

**BUILDING DEMOLITION WITH ON-SITE CONTAINMENT**

**Appendix B**  
**Cost Savings - Vegetative Cap**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

TABLE B-1						
COST SUMMARY						
Alternative	Option	Description	Capital Cost	Institutional Controls	Operation & Maintenance	Total
3	NA	Building Demolition with On-site Containment (25-75% Hazardous)	\$ 12,380,000	\$ 55,000	\$ 1,092,000	\$ 13,527,000

Appendix B  
Cost Savings - Vegetative Cap  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

ALTERNATIVE 3  
BUILDING DEMOLITION WITH ON-SITE CONTAINMENT (25-75% HAZARDOUS)

Table B-2				
Alternative 3 - Building Demolition with On-site Containment (25-75% Hazardous)				
Source	Description	Subtotal	Contingency	Total (Rounded)
Table B-3	Design and Construction	\$ 9,522,843	\$ 2,856,852.84	\$ 12,380,000
Table B-4	Institutional Controls	\$ 42,500	\$ 12,750	\$ 55,000
Table B-5	Operation and Maintenance	\$ 839,835	\$ 251,950.44	\$ 1,092,000
Contingency		30%	\$ 3,121,553.28	
Total		\$ 13,527,000		



**Appendix B  
Cost Savings - Vegetative Cap  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa**

**Capital Cost**

Location factor (for zip code 433xx)

ECHOS

Get-a-Quote

1
1.04

Note: Location factor applied only to national average unit costs; not applied to local unit costs such as from vendors or Means.

Overhead and Profit (O&P)

General

Means

RACER

Contractor quote

Professional judgment

25%
-
25%
5%
-

Typical general contractor overhead and profit

NA

NA

Prime contractor markup

Not marked-up

Inflation

2.08%
-------

Avg. annual inflation from 2010 to 2015

Table B-3					
Alternative 3 - Building Demolition with On-site Containment (25-75% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Construction Subtotal</b>				<b>\$ 7,532,464</b>
	<b>Site Preparation</b>				<b>\$ 15,000</b>
1	Temporary facilities	1.0	ls	\$ 15,000.00	\$ 15,000
	<b>Asbestos Survey</b>				<b>\$ 8,703</b>
2	Asbestos survey	1.0	ls	\$ 8,702.50	\$ 8,703
	<b>Equipment Decontamination</b>				<b>\$ 81,685</b>
3	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 69,645.00	\$ 69,645
4	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Asbestos Removal and Disposal</b>				<b>\$ 603,711</b>
5	Asbestos removal - Office Building	1.0	ls	\$ 86,733.75	\$ 86,734
6	Asbestos removal - Production Building	1.0	ls	\$ 170,078.75	\$ 170,079
7	Asbestos removal - Building 1	1.0	ls	\$ 43,548.75	\$ 43,549
8	Asbestos removal - Building 2	1.0	ls	\$ 209,323.75	\$ 209,324
9	Asbestos removal - Building 3	1.0	ls	\$ 94,025.00	\$ 94,025
	<b>PCB Removal and Disposal</b>				<b>\$ 330,886</b>
10	PCB removal - Building 2	1.0	ls	\$ 81,773.75	\$ 81,774
11	PCB removal - Building 3	1.0	ls	\$ 133,537.50	\$ 133,538
12	PCB disposal	424.0	tons	\$ 272.58	\$ 115,574
	<b>Metal Decontamination</b>				<b>\$ 96,478</b>
13	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 84,437.50	\$ 84,438
14	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Building Demolition</b>				<b>\$ 785,685</b>
15	Building demolition - Office Building	1.0	ls	\$ 76,375.84	\$ 76,376
16	Building demolition - Production Building	1.0	ls	\$ 504,541.80	\$ 504,542
17	Building demolition - Building 1	1.0	ls	\$ 14,489.11	\$ 14,489
18	Building demolition - Building 2	1.0	ls	\$ 137,498.69	\$ 137,499
19	Building demolition - Building 3	1.0	ls	\$ 51,387.91	\$ 51,388
20	Building demolition - Walkway	1.0	ls	\$ 1,390.95	\$ 1,391

**Appendix B**  
**Cost Savings - Vegetative Cap**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table B-3					
Alternative 3 - Building Demolition with On-site Containment (25-75% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Waste Characterization</b>				<b>\$ 75,349</b>
21	Sampling and analysis for pesticides, PCBs, and VOCs (building debris and wastewater)	1.0	ls	\$ 75,348.75	\$ 75,349
	<b>Vegetative Cap</b>				<b>\$ 2,273,423</b>
22	Seeding, vegetative cover	16.9	ac	\$ 4,993.43	\$ 84,489
23	Topsoil, 6 inches deep	17,065.6	lcy	\$ 51.00	\$ 870,348
24	Fill, 6 inches deep	17,065.6	cy	\$ 34.89	\$ 595,378
25	Clay, low permeability, 6 inches deep	19,113.5	cy	\$ 37.84	\$ 723,208
	<b>Prescriptive Cap</b>				<b>\$ 2,684,038</b>
26	Seeding, vegetative cover	3.7	ac	\$ 4,993.48	\$ 18,576
27	Topsoil, 12 inches deep	7,504.7	lcy	\$ 51.00	\$ 382,742
28	Fill, 6 inch lifts (includes delivery, spreading, and compaction)	22,514.2	cy	\$ 34.89	\$ 785,465
29	Clay, low permeability, 2 feet (includes 0.5-1.4 feet debris foundation layer)	16,811.0	cy	\$ 37.84	\$ 636,086
30	Drainage netting, geotextile fabric heat-bonded 2 sides	178,312.6	sf	\$ 0.85	\$ 151,566
31	60 Mil polymetric liner, high-density polyethylene	178,312.6	sf	\$ 0.93	\$ 164,939
32	Sodium bentonite flocculant aid	907,773.0	lb	\$ 0.60	\$ 544,664
	<b>Crushing</b>				<b>\$ 516,060</b>
33	Bulldozer (crushing debris for fill)	800.0	hour	\$ 267.40	\$ 213,920
34	Backhoe, 0.75 CY (crushing debris for fill)	800.0	hour	\$ 142.55	\$ 114,040
35	Jackhammer (crushing of debris for fill)	800.0	hour	\$ 235.13	\$ 188,100
	<b>Measurement</b>				<b>\$ 61,446</b>
36	Pre-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
37	Post-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
Construction subtotal					\$ 7,532,464
Construction Contractor Mobe/Demobe, Site Prep and Submittals					\$ 753,246.40
Pre-design investigation					\$ 753,246.40
Engineering design					\$ 1,355,843.52
Project management and construction oversight					\$ 527,272.48
Recycling of metal (15,547 tons at \$90 per ton)					\$ (1,399,230.00)
<b>Capital Cost Subtotal</b>					<b>\$ 9,522,843</b>

**Appendix B**  
**Cost Savings - Vegetative Cap**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table B-4					
Institutional Controls					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Institutional Controls Subtotal</b>				<b>\$ 42,500</b>
38	Prepare LUC Implementation Plan (mid-level staff with senior review)	250	hr	\$ 110.00	\$ 27,500
39	Meetings with agencies (senior staff and attorneys)	60	hr	\$ 250.00	\$ 15,000

**Operation and Maintenance**

Table B-5					
Operation and Maintenance					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Annual Operation and Maintenance Subtotal</b>				<b>63,332</b>
	<b>Cap and Groundwater Monitoring</b>				<b>\$ 11,140</b>
40	Groundwater sampling (included as part of semi-annual groundwater sampling for Operable Unit 4)	2.0	day	\$ -	\$ -
41	Sample analysis for pesticides (VOCs sampled during semi-annual groundwater sampling for Operable Unit 4)	20.0	ea	\$ 81.99	\$ 1,640
42	Monitoring annual report (included with semi-annual monitoring report for Operable Unit 4)	1.0	ls	\$ -	\$ -
43	Engineer site visit (1 per year)	1.0	ls	\$ 3,500.00	\$ 3,500
44	Proj. Mgmt. 2 hrs/wk on proj for 24 weeks	48.0	hr	\$ 125.00	\$ 6,000
	<b>Cap Repair (every 3 years)</b>				<b>\$ -</b>
45	Seal coat	0.0	sf	\$ 0.17	\$ -
46	Crack sealing	0.0	lf	\$ 0.86	\$ -
	<b>Prescriptive Cap Repair</b>				<b>\$ 52,192</b>
47	Re-seeding (25 percent of cap)	5.2	acre	\$ 4,993.48	\$ 25,716
48	Fertilization	20.6	acre	\$ 921.16	\$ 18,976
49	Erosion repair	1.0	ls	\$ 7,500.00	\$ 7,500

**Appendix B**  
**Cost Savings - Vegetative Cap**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Annual Discount Rate <sup>1</sup>:

30-Yr 7.00%

Table B-6						
Present Value Analysis						
Year	Annual Discount Factor <sup>2</sup>	Alternative 3 - Building Demolition with On-site Containment (25-75% Hazardous)				
		Operation and Maintenance Costs				
	30-Yr	Description	Future Cost <sup>3</sup>	Description	Future Cost <sup>3</sup>	Present Value (2015)
0	1.000					\$0
1	0.935	Cap O&M	\$63,332			\$59,189
2	0.873	Cap O&M	\$63,332			\$55,317
3	0.816	Cap O&M	\$63,332			\$51,698
4	0.763	Cap O&M	\$63,332			\$48,316
5	0.713	Cap O&M	\$63,332	Five-Year Review	\$25,000	\$62,979
6	0.666	Cap O&M	\$63,332			\$42,201
7	0.623	Cap O&M	\$63,332			\$39,440
8	0.582	Cap O&M	\$63,332			\$36,860
9	0.544	Cap O&M	\$63,332			\$34,448
10	0.508	Cap O&M	\$63,332	Five-Year Review	\$25,000	\$44,904
11	0.475	Cap O&M	\$63,332			\$30,089
12	0.444	Cap O&M	\$63,332			\$28,120
13	0.415	Cap O&M	\$63,332			\$26,281
14	0.388	Cap O&M	\$63,332			\$24,561
15	0.362	Cap O&M	\$63,332	Five-Year Review	\$25,000	\$32,016
16	0.339	Cap O&M	\$63,332			\$21,453
17	0.317	Cap O&M	\$63,332			\$20,049
18	0.296	Cap O&M	\$63,332			\$18,738
19	0.277	Cap O&M	\$63,332			\$17,512
20	0.258	Cap O&M	\$63,332	Five-Year Review	\$25,000	\$22,827
21	0.242	Cap O&M	\$63,332			\$15,296
22	0.226	Cap O&M	\$63,332			\$14,295
23	0.211	Cap O&M	\$63,332			\$13,360
24	0.197	Cap O&M	\$63,332			\$12,486
25	0.184	Cap O&M	\$63,332	Five-Year Review	\$25,000	\$16,275
26	0.172	Cap O&M	\$63,332			\$10,905
27	0.161	Cap O&M	\$63,332			\$10,192
28	0.150	Cap O&M	\$63,332			\$9,525
29	0.141	Cap O&M	\$63,332			\$8,902
30	0.131	Cap O&M	\$63,332	Five-Year Review	\$25,000	\$11,604
<b>Total Present Value of Periodic Cost</b>						<b>\$839,835</b>

Notes:

1 From "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000)

2 Annual discount factor =  $1/(1+i)^t$ , where i = discount rate (includes inflation and interest) and t = year

3 Current dollar cost of future event

O&M Operations and maintenance

**Appendix B**  
**Cost Savings - Non-hazardous Debris Disposal in SPA**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

TABLE B-1						
COST SUMMARY						
Alternative	Option	Description	Capital Cost	Institutional Controls	Operation & Maintenance	Total
3	NA	Building Demolition with On-site Containment (25-75% Hazardous)	\$ 13,403,000	\$ 55,000	\$ 1,078,000	\$ 14,536,000

Appendix B  
Cost Savings - Non-hazardous Debris Disposal in SPA  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

ALTERNATIVE 3  
BUILDING DEMOLITION WITH ON-SITE CONTAINMENT (25-75% HAZARDOUS)

Table B-2				
Alternative 3 - Building Demolition with On-site Containment (25-75% Hazardous)				
Source	Description	Subtotal	Contingency	Total (Rounded)
Table B-3	Design and Construction	\$ 10,309,675	\$ 3,092,902.55	\$ 13,403,000
Table B-4	Institutional Controls	\$ 42,500	\$ 12,750	\$ 55,000
Table B-5	Operation and Maintenance	\$ 829,078	\$ 248,723.44	\$ 1,078,000
Contingency		30%	\$ 3,354,375.99	
Total				\$ 14,536,000

**Appendix B**  
**Cost Savings - Non-hazardous Debris Disposal in SPA**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

**Capital Cost**

Location factor (for zip code 433xx)

ECHOS

Get-a-Quote

1
1.04

Note: Location factor applied only to national average unit costs; not applied to local unit costs such as from vendors or Means.

Overhead and Profit (O&P)

General

Means

RACER

Contractor quote

Professional judgment

25%
-
25%
5%
-

Typical general contractor overhead and profit

NA

NA

Prime contractor markup

Not marked-up

Inflation

2.08%
-------

Avg. annual inflation from 2010 to 2015

Table B-3					
Alternative 3 - Building Demolition with On-site Containment (25-75% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Construction Subtotal</b>				<b>\$ 8,075,107</b>
	<b>Site Preparation</b>				<b>\$ 15,000</b>
1	Temporary facilities	1.0	ls	\$ 15,000.00	\$ 15,000
	<b>Asbestos Survey</b>				<b>\$ 8,703</b>
2	Asbestos survey	1.0	ls	\$ 8,702.50	\$ 8,703
	<b>Equipment Decontamination</b>				<b>\$ 81,685</b>
3	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 69,645.00	\$ 69,645
4	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Asbestos Removal and Disposal</b>				<b>\$ 603,711</b>
5	Asbestos removal - Office Building	1.0	ls	\$ 86,733.75	\$ 86,734
6	Asbestos removal - Production Building	1.0	ls	\$ 170,078.75	\$ 170,079
7	Asbestos removal - Building 1	1.0	ls	\$ 43,548.75	\$ 43,549
8	Asbestos removal - Building 2	1.0	ls	\$ 209,323.75	\$ 209,324
9	Asbestos removal - Building 3	1.0	ls	\$ 94,025.00	\$ 94,025
	<b>PCB Removal and Disposal</b>				<b>\$ 330,886</b>
10	PCB removal - Building 2	1.0	ls	\$ 81,773.75	\$ 81,774
11	PCB removal - Building 3	1.0	ls	\$ 133,537.50	\$ 133,538
12	PCB disposal	424.0	tons	\$ 272.58	\$ 115,574
	<b>Metal Decontamination</b>				<b>\$ 96,478</b>
13	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 84,437.50	\$ 84,438
14	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Building Demolition</b>				<b>\$ 785,685</b>
15	Building demolition - Office Building	1.0	ls	\$ 76,375.84	\$ 76,376
16	Building demolition - Production Building	1.0	ls	\$ 504,541.80	\$ 504,542
17	Building demolition - Building 1	1.0	ls	\$ 14,489.11	\$ 14,489
18	Building demolition - Building 2	1.0	ls	\$ 137,498.69	\$ 137,499
19	Building demolition - Building 3	1.0	ls	\$ 51,387.91	\$ 51,388
20	Building demolition - Walkway	1.0	ls	\$ 1,390.95	\$ 1,391

**Appendix B**  
**Cost Savings - Non-hazardous Debris Disposal in SPA**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table B-3					
Alternative 3 - Building Demolition with On-site Containment (25-75% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Waste Characterization</b>				<b>\$ 75,349</b>
21	Sampling and analysis for pesticides, PCBs, and VOCs (building debris and wastewater)	1.0	ls	\$ 75,348.75	\$ 75,349
	<b>Asphalt Cap</b>				<b>\$ 2,816,066</b>
22	Asphalt pavement - 6 inch base course layer, 3 inch topping (includes 1.6-1.8 feet debris foundation layer)	60,076.5	sy	\$ 46.60	\$ 2,799,566
23	Cap material sampling and analysis (every 500 ft)	6.0	ea	\$ 2,000.00	\$ 12,000
24	Cap thickness verification (every 100 ft)	30.0	ea	\$ 150.00	\$ 4,500
	<b>Prescriptive Cap</b>				<b>\$ 2,684,038</b>
25	Seeding, vegetative cover	3.7	ac	\$ 4,993.48	\$ 18,576
26	Topsoil, 12 inches deep	7,504.7	lcy	\$ 51.00	\$ 382,742
27	Fill, 6 inch lifts (includes delivery, spreading, and compaction)	22,514.2	cy	\$ 34.89	\$ 785,465
28	Clay, low permeability, 2 feet (includes 0.5-1.4 feet debris foundation layer)	16,811.0	cy	\$ 37.84	\$ 636,086
29	Drainage netting, geotextile fabric heat-bonded 2 sides	178,312.6	sf	\$ 0.85	\$ 151,566
30	60 Mil polymetric liner, high-density polyethylene	178,312.6	sf	\$ 0.93	\$ 164,939
31	Sodium bentonite flocculant aid	907,773.0	lb	\$ 0.60	\$ 544,664
	<b>Crushing</b>				<b>\$ 516,060</b>
32	Bulldozer (crushing debris for fill)	800.0	hour	\$ 267.40	\$ 213,920
33	Backhoe, 0.75 CY (crushing debris for fill)	800.0	hour	\$ 142.55	\$ 114,040
34	Jackhammer (crushing of debris for fill)	800.0	hour	\$ 235.13	\$ 188,100
	<b>Measurement</b>				<b>\$ 61,446</b>
35	Pre-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
36	Post-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
Construction subtotal					\$ 8,075,107
Construction Contractor Mobe/Demobe, Site Prep and Submittals					10% \$ 807,510.70
Pre-design investigation					10% \$ 807,510.70
Engineering design					18% \$ 1,453,519.26
Project management and construction oversight					7% \$ 565,257.49
Recycling of metal (15,547 tons at \$90 per ton)					\$ (1,399,230.00)
<b>Capital Cost Subtotal</b>					<b>\$ 10,309,675</b>



**Appendix B**  
**Cost Savings - Non-hazardous Debris Disposal in SPA**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table B-4					
Institutional Controls					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Institutional Controls Subtotal</b>				<b>\$ 42,500</b>
37	Prepare LUC Implementation Plan (mid-level staff with senior review)	250	hr	\$ 110.00	\$ 27,500
38	Meetings with agencies (senior staff and attorneys)	60	hr	\$ 250.00	\$ 15,000

**Operation and Maintenance**

Table B-5					
Operation and Maintenance					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Annual Operation and Maintenance Subtotal</b>				<b>65,388</b>
	<b>Cap and Groundwater Monitoring</b>				<b>\$ 11,140</b>
39	Groundwater sampling (included as part of semi-annual groundwater sampling for Operable Unit 4)	2.0	day	\$ -	\$ -
40	Sample analysis for pesticides (VOCs sampled during semi-annual groundwater sampling for Operable Unit 4)	20.0	ea	\$ 81.99	\$ 1,640
41	Monitoring annual report (included with semi-annual monitoring report for Operable Unit 4)	1.0	ls	\$ -	\$ -
42	Engineer site visit (1 per year)	1.0	ls	\$ 3,500.00	\$ 3,500
43	Proj. Mgmt. 2 hrs/wk on proj for 24 weeks	48.0	hr	\$ 125.00	\$ 6,000
	<b>Cap Repair (every 3 years)</b>				<b>\$ 131,162</b>
44	Seal coat	540,688.5	sf	\$ 0.17	\$ 92,620
45	Crack sealing	45,000.0	lf	\$ 0.86	\$ 38,542
	<b>Prescriptive Cap Repair</b>				<b>\$ 10,527</b>
46	Re-seeding (25 percent of cap)	0.9	acre	\$ 4,993.48	\$ 4,619
47	Fertilization	3.7	acre	\$ 921.16	\$ 3,408
48	Erosion repair	1.0	ls	\$ 2,500.00	\$ 2,500

**Appendix B**  
**Cost Savings - Non-hazardous Debris Disposal in SPA**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Annual Discount Rate <sup>1</sup>:

30-Yr 7.00%

Table B-6						
Present Value Analysis						
Year	Annual Discount Factor <sup>2</sup>	Alternative 3 - Building Demolition with On-site Containment (25-75% Hazardous)				
		Operation and Maintenance Costs				
		Description	Future Cost <sup>3</sup>	Description	Future Cost <sup>3</sup>	Present Value (2015)
0	1.000					\$0
1	0.935	Cap O&M	\$21,667			\$20,250
2	0.873	Cap O&M	\$21,667			\$18,925
3	0.816	Cap O&M	\$152,829			\$124,754
4	0.763	Cap O&M	\$21,667			\$16,530
5	0.713	Cap O&M	\$21,667	Five-Year Review	\$25,000	\$33,273
6	0.666	Cap O&M	\$152,829			\$101,836
7	0.623	Cap O&M	\$21,667			\$13,493
8	0.582	Cap O&M	\$21,667			\$12,610
9	0.544	Cap O&M	\$152,829			\$83,129
10	0.508	Cap O&M	\$21,667	Five-Year Review	\$25,000	\$23,723
11	0.475	Cap O&M	\$21,667			\$10,294
12	0.444	Cap O&M	\$152,829			\$67,858
13	0.415	Cap O&M	\$21,667			\$8,991
14	0.388	Cap O&M	\$21,667			\$8,403
15	0.362	Cap O&M	\$152,829	Five-Year Review	\$25,000	\$64,453
16	0.339	Cap O&M	\$21,667			\$7,339
17	0.317	Cap O&M	\$21,667			\$6,859
18	0.296	Cap O&M	\$152,829			\$45,217
19	0.277	Cap O&M	\$21,667			\$5,991
20	0.258	Cap O&M	\$21,667	Five-Year Review	\$25,000	\$12,060
21	0.242	Cap O&M	\$152,829			\$36,910
22	0.226	Cap O&M	\$21,667			\$4,891
23	0.211	Cap O&M	\$21,667			\$4,571
24	0.197	Cap O&M	\$152,829			\$30,130
25	0.184	Cap O&M	\$21,667	Five-Year Review	\$25,000	\$8,598
26	0.172	Cap O&M	\$21,667			\$3,731
27	0.161	Cap O&M	\$152,829			\$24,595
28	0.150	Cap O&M	\$21,667			\$3,259
29	0.141	Cap O&M	\$21,667			\$3,046
30	0.131	Cap O&M	\$152,829	Five-Year Review	\$25,000	\$23,361
<b>Total Present Value of Periodic Cost</b>						<b>\$829,078</b>

Notes:

1 From "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000)

2 Annual discount factor =  $1/(1+i)^t$ , where i = discount rate (includes inflation and interest) and t = year

3 Current dollar cost of future event

O&M Operations and maintenance

**Appendix B**  
**Cost Savings - Berm Design**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

TABLE B-1						
COST SUMMARY						
Alternative	Option	Description	Capital Cost	Institutional Controls	Operation & Maintenance	Total
3	NA	Building Demolition with On-site Containment (25-75% Hazardous)	\$ 11,277,000	\$ 55,000	\$ 925,000	\$ 12,257,000

Appendix B  
Cost Savings - Berm Design  
Building Demolition  
Des Moines TCE Site  
Des Moines, Iowa

ALTERNATIVE 3  
BUILDING DEMOLITION WITH ON-SITE CONTAINMENT (25-75% HAZARDOUS)

Table B-2				
Alternative 3 - Building Demolition with On-site Containment (25-75% Hazardous)				
Source	Description	Subtotal	Contingency	Total (Rounded)
Table B-3	Design and Construction	\$ 8,674,552	\$ 2,602,365.66	\$ 11,277,000
Table B-4	Institutional Controls	\$ 42,500	\$ 12,750	\$ 55,000
Table B-5	Operation and Maintenance	\$ 711,813	\$ 213,543.96	\$ 925,000
Contingency		30%	\$ 2,828,659.62	
Total			\$	12,257,000

**Appendix B**  
**Cost Savings - Berm Design**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

**Capital Cost**

Location factor (for zip code 433xx)	
ECHOS	1
Get-a-Quote	1.04

Note: Location factor applied only to national average unit costs; not applied to local unit costs such as from vendors or Means.

Overhead and Profit (O&P)		
General	25%	Typical general contractor overhead and profit
Means	-	NA
RACER	25%	NA
Contractor quote	5%	Prime contractor markup
Professional judgment	-	Not marked-up

Inflation	2.08%	Avg. annual inflation from 2010 to 2015
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Table B-3					
Alternative 3 - Building Demolition with On-site Containment (25-75% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Construction Subtotal</b>				<b>\$ 6,947,436</b>
	<b>Site Preparation</b>				<b>\$ 15,000</b>
1	Temporary facilities	1.0	ls	\$ 15,000.00	\$ 15,000
	<b>Asbestos Survey</b>				<b>\$ 8,703</b>
2	Asbestos survey	1.0	ls	\$ 8,702.50	\$ 8,703
	<b>Equipment Decontamination</b>				<b>\$ 81,685</b>
3	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 69,645.00	\$ 69,645
4	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Asbestos Removal and Disposal</b>				<b>\$ 603,711</b>
5	Asbestos removal - Office Building	1.0	ls	\$ 86,733.75	\$ 86,734
6	Asbestos removal - Production Building	1.0	ls	\$ 170,078.75	\$ 170,079
7	Asbestos removal - Building 1	1.0	ls	\$ 43,548.75	\$ 43,549
8	Asbestos removal - Building 2	1.0	ls	\$ 209,323.75	\$ 209,324
9	Asbestos removal - Building 3	1.0	ls	\$ 94,025.00	\$ 94,025
	<b>PCB Removal and Disposal</b>				<b>\$ 330,886</b>
10	PCB removal - Building 2	1.0	ls	\$ 81,773.75	\$ 81,774
11	PCB removal - Building 3	1.0	ls	\$ 133,537.50	\$ 133,538
12	PCB disposal	424.0	tons	\$ 272.58	\$ 115,574
	<b>Metal Decontamination</b>				<b>\$ 96,478</b>
13	Decontamination facilities (1,500 square feet)	1.0	ls	\$ 84,437.50	\$ 84,438
14	Transportation and disposal (2,750 gallons of wastewater)	1.0	ls	\$ 12,040.00	\$ 12,040
	<b>Building Demolition</b>				<b>\$ 785,685</b>
15	Building demolition - Office Building	1.0	ls	\$ 76,375.84	\$ 76,376
16	Building demolition - Production Building	1.0	ls	\$ 504,541.80	\$ 504,542
17	Building demolition - Building 1	1.0	ls	\$ 14,489.11	\$ 14,489
18	Building demolition - Building 2	1.0	ls	\$ 137,498.69	\$ 137,499
19	Building demolition - Building 3	1.0	ls	\$ 51,387.91	\$ 51,388
20	Building demolition - Walkway	1.0	ls	\$ 1,390.95	\$ 1,391

**Appendix B**  
**Cost Savings - Berm Design**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table B-3					
Alternative 3 - Building Demolition with On-site Containment (25-75% Hazardous)					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Waste Characterization</b>				<b>\$ 75,349</b>
21	Sampling and analysis for pesticides, PCBs, and VOCs (building debris and wastewater)	1.0	ls	\$ 75,348.75	\$ 75,349
	<b>Asphalt Cap</b>				<b>\$ 542,099</b>
22	Asphalt pavement - 6 inch base course layer, 3 inch topping	11,515.0	sy	\$ 46.60	\$ 536,599
23	Cap material sampling and analysis (every 500 ft)	2.0	ea	\$ 2,000.00	\$ 4,000
24	Cap thickness verification (every 100 ft)	10.0	ea	\$ 150.00	\$ 1,500
	<b>Walking Path</b>				<b>\$ 1,146,296</b>
25	Clay, low permeability, 6 inches deep	7,591.8	cy	\$ 37.84	\$ 287,254
26	Fill, 6 inches deep	6,778.4	cy	\$ 34.89	\$ 236,481
27	Topsoil, 6 inches deep	6,778.4	lcy	\$ 51.00	\$ 345,697
28	Seeding, vegetative cover	6.7	ac	\$ 4,993.48	\$ 33,556
29	Sidewalk, 4 inches deep with mesh	35,979.0	sf	\$ 6.76	\$ 243,308
	<b>Prescriptive Cap</b>				<b>\$ 2,684,038</b>
30	Seeding, vegetative cover	3.7	ac	\$ 4,993.48	\$ 18,576
31	Topsoil, 12 inches deep	7,504.7	lcy	\$ 51.00	\$ 382,742
32	Fill, 6 inch lifts (includes delivery, spreading, and compaction)	22,514.2	cy	\$ 34.89	\$ 785,465
33	Clay, low permeability, 2 feet (includes 0.5-1.4 feet debris foundation layer)	16,811.0	cy	\$ 37.84	\$ 636,086
34	Drainage netting, geotextile fabric heat-bonded 2 sides	178,312.6	sf	\$ 0.85	\$ 151,566
35	60 Mil polymeric liner, high-density polyethylene	178,312.6	sf	\$ 0.93	\$ 164,939
36	Sodium bentonite flocculant aid	907,773.0	lb	\$ 0.60	\$ 544,664
	<b>Crushing</b>				<b>\$ 516,060</b>
37	Bulldozer (crushing debris for fill)	800.0	hour	\$ 267.40	\$ 213,920
38	Backhoe, 0.75 CY (crushing debris for fill)	800.0	hour	\$ 142.55	\$ 114,040
39	Jackhammer (crushing of debris for fill)	800.0	hour	\$ 235.13	\$ 188,100
	<b>Measurement</b>				<b>\$ 61,446</b>
40	Pre-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
41	Post-construction surveying	14.0	days	\$ 2,194.52	\$ 30,723
Construction subtotal				\$	6,947,436
Construction Contractor Move/Demove, Site Prep and Submittals				10%	\$ 694,743.60
Pre-design investigation				10%	\$ 694,743.60
Engineering design				18%	\$ 1,250,538.48
Project management and construction oversight				7%	\$ 486,320.52
Recycling of metal (15,547 tons at \$90 per ton)					\$ (1,399,230.00)
<b>Capital Cost Subtotal</b>				<b>\$</b>	<b>8,674,552</b>

**Appendix B**  
**Cost Savings - Berm Design**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Table B-4					
Institutional Controls					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Institutional Controls Subtotal</b>				<b>\$ 42,500</b>
42	Prepare LUC Implementation Plan (mid-level staff with senior review)	250	hr	\$ 110.00	\$ 27,500
43	Meetings with agencies (senior staff and attorneys)	60	hr	\$ 250.00	\$ 15,000

**Operation and Maintenance**

Table B-5					
Operation and Maintenance					
Item	Description	Quantity	Unit	Unit Price (Incl. O&P)	Total Cost
	<b>Annual Operation and Maintenance Subtotal</b>				<b>\$ 58,482</b>
	<b>Cap and Groundwater Monitoring</b>				<b>\$ 11,140</b>
44	Groundwater sampling (included as part of semi-annual groundwater sampling for Operable Unit 4)	2.0	day	\$ -	\$ -
45	Sample analysis for pesticides (VOCs sampled during semi-annual groundwater sampling for Operable Unit 4)	20.0	ea	\$ 81.99	\$ 1,640
46	Monitoring annual report (included with semi-annual monitoring report for Operable Unit 4)	1.0	ls	\$ -	\$ -
47	Engineer site visit (1 per year)	1.0	ls	\$ 3,500.00	\$ 3,500
48	Proj. Mgmt. 2 hrs/wk on proj for 24 weeks	48.0	hr	\$ 125.00	\$ 6,000
	<b>Cap Repair (every 3 years)</b>				<b>\$ 20,965</b>
49	Seal coat	103,635.0	sf	\$ 0.17	\$ 17,753
50	Crack sealing	3,750.0	lf	\$ 0.86	\$ 3,212
	<b>Prescriptive Cap Repair</b>				<b>\$ 10,527</b>
51	Re-seeding (25 percent of cap)	0.9	acre	\$ 4,993.48	\$ 4,619
52	Fertilization	3.7	acre	\$ 921.16	\$ 3,408
53	Erosion repair	1.0	ls	\$ 2,500.00	\$ 2,500
	<b>Walking Path Repair</b>				<b>\$ 24,827</b>
54	Re-seeding (25 percent of berm)	1.7	acre	\$ 4,993.48	\$ 8,364
55	Fertilization	6.7	acre	\$ 921.16	\$ 6,172
56	Erosion repair	1.0	ls	\$ 2,500.00	\$ 2,500
57	Crack sealing	1,200.0	lf	\$ 0.86	\$ 1,028
58	Concrete replacement	1,000.0	sf	\$ 6.76	\$ 6,763
	<b>Five-Year Review (every 5 years)</b>				<b>\$ 25,000</b>
59	Five-year review	1.0	ls	\$ 25,000.00	\$ 25,000

**Appendix B**  
**Cost Savings - Berm Design**  
**Building Demolition**  
**Des Moines TCE Site**  
**Des Moines, Iowa**

Annual Discount Rate <sup>1</sup>:

30-Yr 7.00%

Table B-6						
Present Value Analysis						
Year	Annual Discount Factor <sup>2</sup>	Alternative 3 - Building Demolition with On-site Containment (25-75% Hazardous)				
		Operation and Maintenance Costs				
	30-Yr	Description	Future Cost <sup>3</sup>	Description	Future Cost <sup>3</sup>	Present Value (2015)
0	1.000					\$0
1	0.935	Cap O&M	\$46,494			\$43,452
2	0.873	Cap O&M	\$46,494			\$40,610
3	0.816	Cap O&M	\$67,459			\$55,067
4	0.763	Cap O&M	\$46,494			\$35,470
5	0.713	Cap O&M	\$46,494	Five-Year Review	\$25,000	\$50,974
6	0.666	Cap O&M	\$67,459			\$44,951
7	0.623	Cap O&M	\$46,494			\$28,954
8	0.582	Cap O&M	\$46,494			\$27,060
9	0.544	Cap O&M	\$67,459			\$36,693
10	0.508	Cap O&M	\$46,494	Five-Year Review	\$25,000	\$36,344
11	0.475	Cap O&M	\$46,494			\$22,089
12	0.444	Cap O&M	\$67,459			\$29,953
13	0.415	Cap O&M	\$46,494			\$19,293
14	0.388	Cap O&M	\$46,494			\$18,031
15	0.362	Cap O&M	\$67,459	Five-Year Review	\$25,000	\$33,511
16	0.339	Cap O&M	\$46,494			\$15,749
17	0.317	Cap O&M	\$46,494			\$14,719
18	0.296	Cap O&M	\$67,459			\$19,959
19	0.277	Cap O&M	\$46,494			\$12,856
20	0.258	Cap O&M	\$46,494	Five-Year Review	\$25,000	\$18,475
21	0.242	Cap O&M	\$67,459			\$16,292
22	0.226	Cap O&M	\$46,494			\$10,494
23	0.211	Cap O&M	\$46,494			\$9,808
24	0.197	Cap O&M	\$67,459			\$13,299
25	0.184	Cap O&M	\$46,494	Five-Year Review	\$25,000	\$13,173
26	0.172	Cap O&M	\$46,494			\$8,006
27	0.161	Cap O&M	\$67,459			\$10,856
28	0.150	Cap O&M	\$46,494			\$6,993
29	0.141	Cap O&M	\$46,494			\$6,535
30	0.131	Cap O&M	\$67,459	Five-Year Review	\$25,000	\$12,146
<b>Total Present Value of Periodic Cost</b>						<b>\$711,813</b>

Notes:

1 From "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000)

2 Annual discount factor =  $1/(1+i)^t$ , where i = discount rate (includes inflation and interest) and t = year

3 Current dollar cost of future event

O&M Operations and maintenance